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APPLICATION
ESTIMATING
SPECIFICATION
and LAYOUT
for
AIR CONDITIONING
HEATING • VENTILATING
PIPING • PLUMBING

AUGUST 1961

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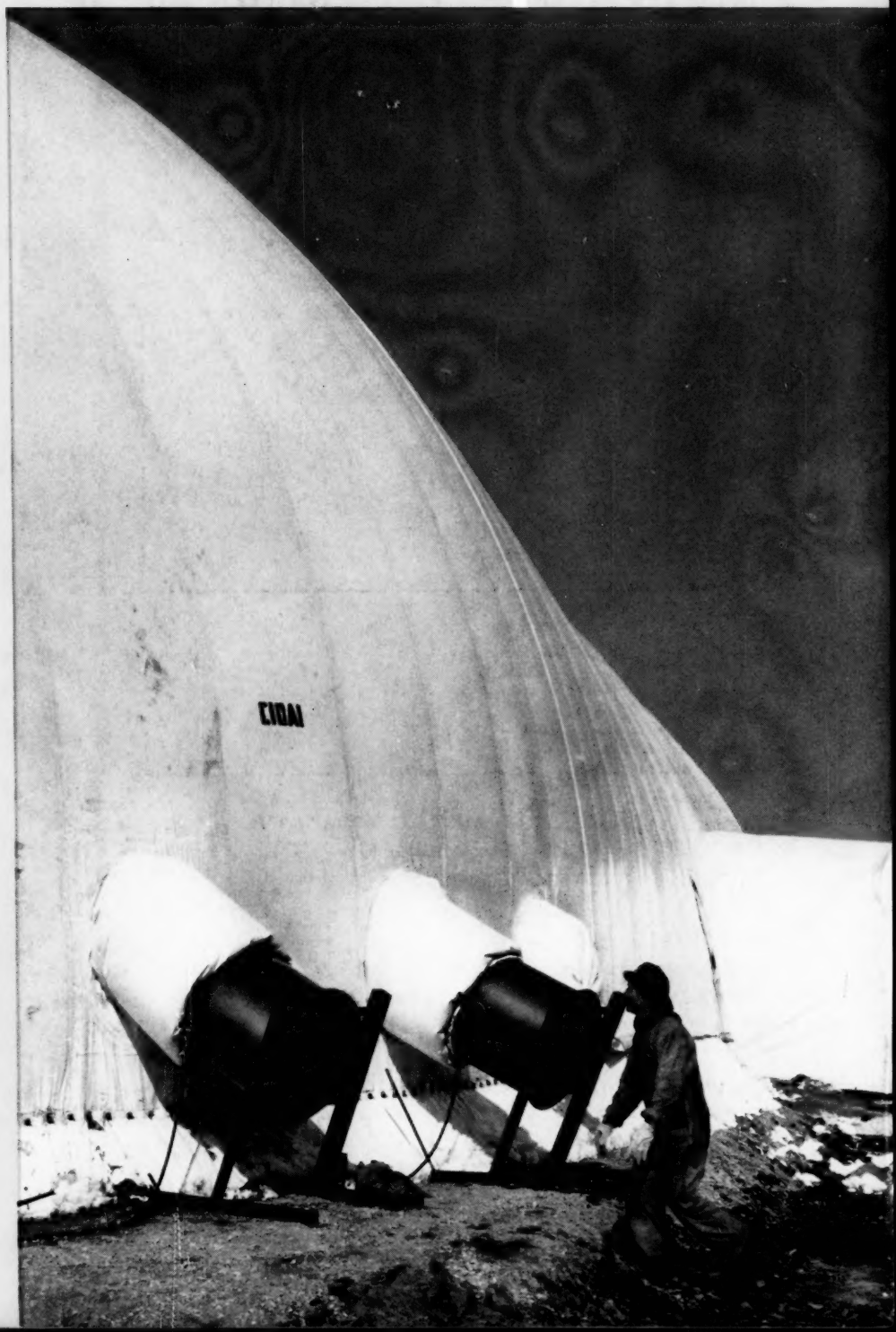
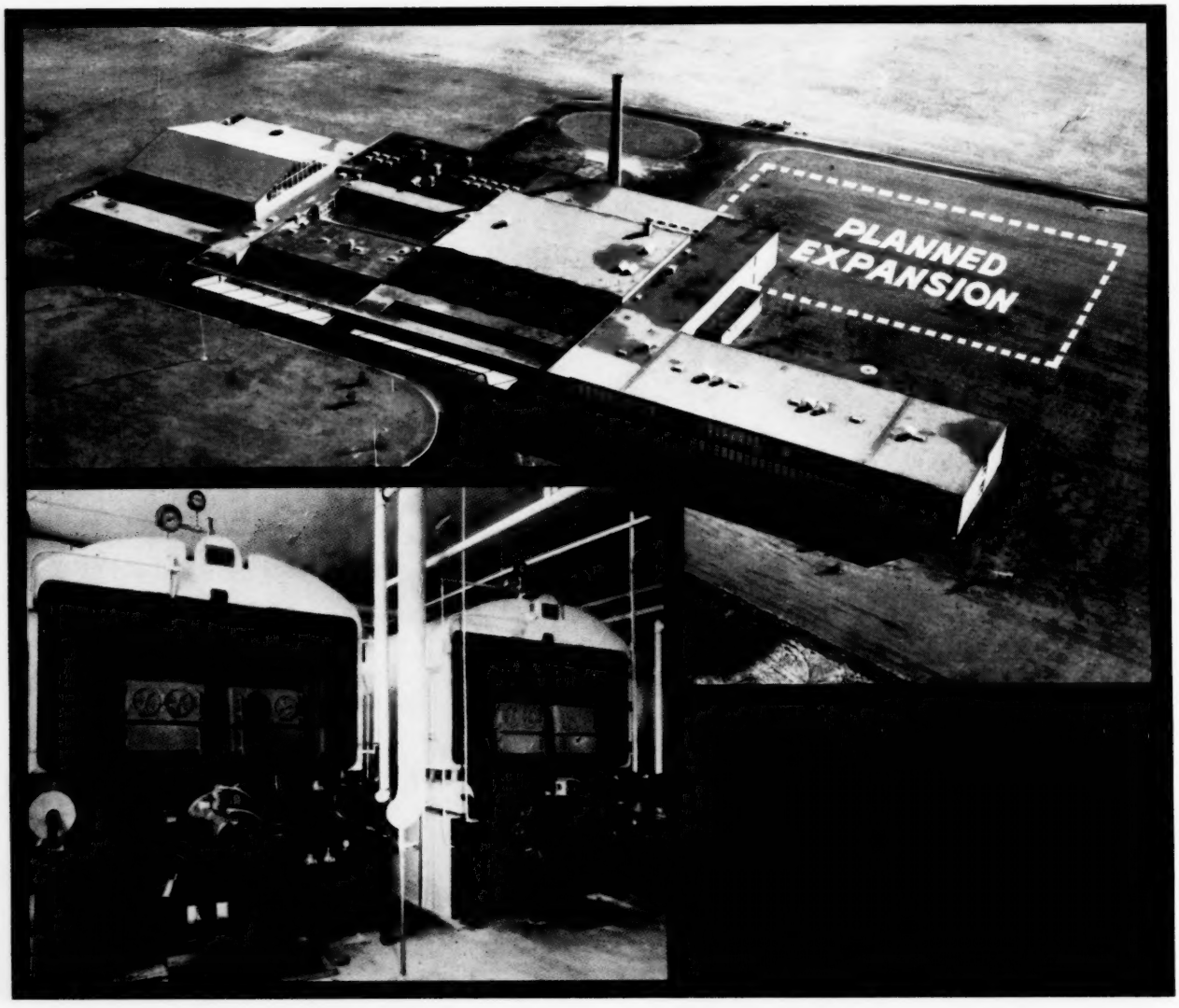


While these two vaneaxial fans utilize "free" inlets and outlets to support an air structure, most fan installations use some type of inlet and outlet connection. A new series on this subject begins on page 70.



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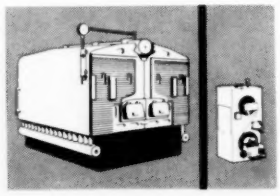
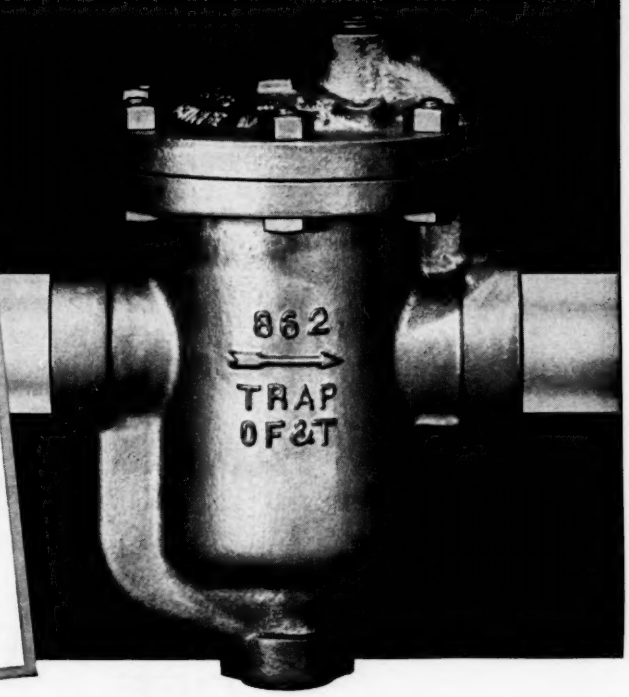


Here are the steam traps designed especially for heating systems . . .



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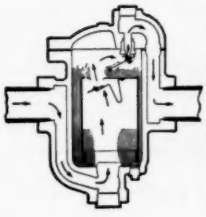
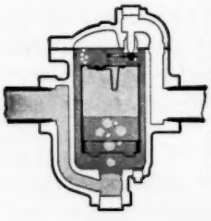


When steam is turned on, it pushes air through the wide open thermic vent and trap discharge valve at full differential pressure between supply and return lines. Condensate formed by incoming steam goes right through.



As steam reaches open float, thermostatic vent closes. Float fills with steam and rises to close trap valve. Residual air and CO_2 escape through fixed vent at steam temperature.

BULLETIN NO. 775 BULLETIN NO. 801

Use the coupon at right to get these helpful bulletins: No. 775 describes O.F.&T. traps fully. No. 801 tells how to select traps for draining unit heaters including data on 30 makes of unit heaters.

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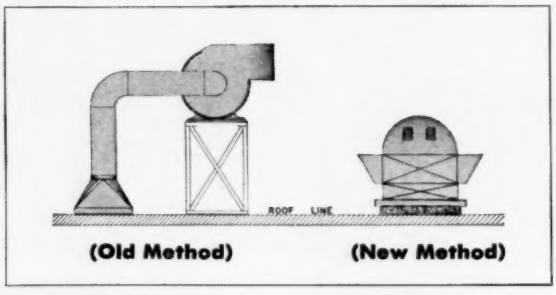

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COVER PHOTO: View of two Westinghouse 15,000-cfm vaneaxial fans supporting a 40 by 80 ft "wairhouse", manufactured by CID Air Structure Co., Chicago, serves to introduce a new series on **inlets and outlets for fans.** The 5-part series, written by W. E. Tracy of Westinghouse Sturtevant Division, begins on page 70 with a discussion of the effect of the inlet connection on fan performance.

HIGH SPOTS in this issue

NEW STACK DATA: After years of careful research, the National Bureau of Standards has published **new data for sizing waste, soil, and vent stacks.** Plumbing designers will be able to specify smaller pipe sizes in non-code areas immediately on the basis of the new tables and curves, appearing on page 53.

STEAM TRAPS: All the design and plant engineer should ever need to know about steam traps is contained in this month's Reference Section, starting on page 75. Author, Jack Scott, **emphasizes trap sizing and selection,** but thoroughly covers such other areas as installation, maintenance and trouble-shooting.

THE OUTLOOK: What lies ahead for large reciprocating compressors and systems, **especially in the size range where reciprocating and centrifugal units now compete,** is the subject of an informative article which appears on page 64. Authors, Henri Soumerai and Dave Shaw, conclude the article with an unusually accurate prognosis.

VAPOR—FROM BOTH ENDS: The problem with insulation for walls of year-round air conditioned houses is that the **direction of vapor migration reverses itself with the seasons,** making the placement and arrangement of a vapor barrier a tricky business. Research on the subject, as reported by H. T. Mei, is making progress. See page 61.

TURBULENCE AND HEAT TRANSFER: The **critical role of turbulence in convective heat transfer** in the field of heating and air conditioning is illuminated by Harrison D. Goodman, who last month resigned his position with Meyer, Strong & Jones, consulting engineers, to set up his own practice in New York City. See page 68.

As a follow-up to Mr. Goodman's article, "Winterizing Chilled Water Systems", that appeared in the November, 1960, ACH&V, see his letter to the editor on page 8, in which he shows how a breakdown put the anti-freeze design of the outside-air coil (developed at MS&J) to the test.

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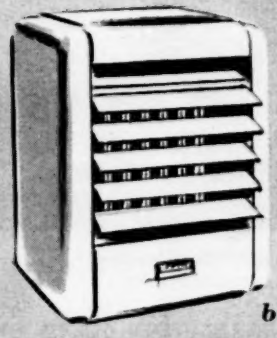

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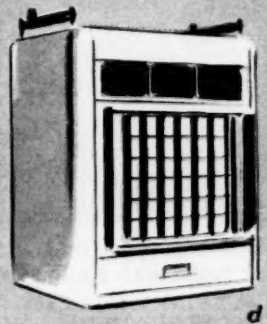

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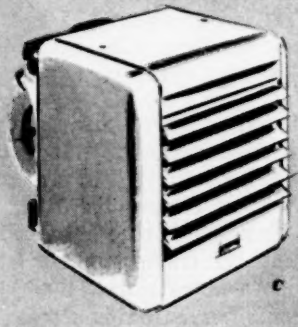

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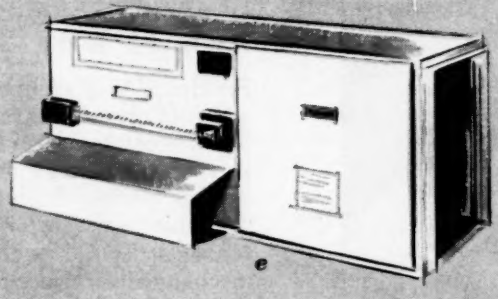

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How Imaginative Engineering Provided Air Conditioning To Fit A School Budget

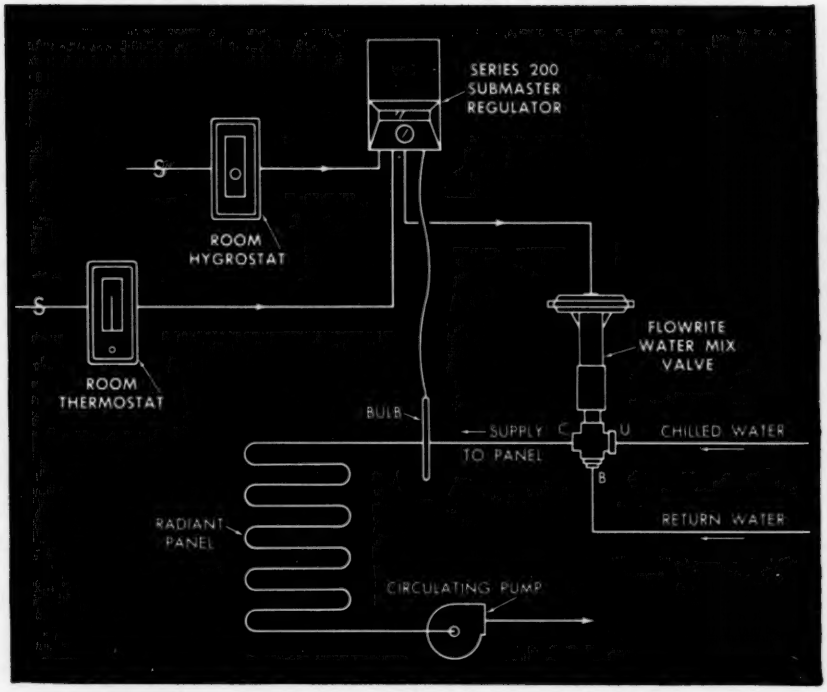
Must school air conditioning always be "too expensive"? Perkins & Will, Chicago architects and engineers, didn't think so last year when they designed suburban Homewood-Flossmoor High School. Without exceeding the school budget, they provided an air conditioned area large enough for complete summer sessions, including 15 classrooms, the library and all administrative offices. Actually, cooling for 25,000 square feet added less than 3½% to normal building cost — less than $4 per square foot of cooled area.

Homewood-Flossmoor High School, Flossmoor, Illinois. Air conditioned section (center) connects to other school facilities by glass-enclosed passageways.
Architects and Engineers: PERKINS & WILL, CHICAGO
Mechanical Contractor: THE ECONOMY PLUMBING AND HEATING CO. OF CHICAGO.

Perkins & Will team of architects and engineers works out details of the cooling system design features and controls for the Homewood-Flossmoor school. From left to right are F. Philip Brotherton, Designer and Project Architect; Rudolph J. Houkal, Chief Mechanical Engineer, and Edward C. Colin, Chief Structural Engineer.

How it was done

Perkins & Will grouped all rooms where both heating and cooling were desired into one section of the school. An interesting design feature is the core of 15 classrooms, surrounded on all sides by other rooms. The fuel savings realized from this "insulated" core help defray the added expense of cooling the entire summer school section. The engineers concentrated all mechanical service equipment beneath this section to eliminate long air conditioning channels. Double ducts and automatic controls were carefully designed for easy switchover to cooling and to take full advantage of tempered return air and outside air during spring and fall seasons.



Ceiling Panel Condensation Control

To back up the mechanical efficiency it so carefully designed into the heating, cooling and ventilating system, the Perkins & Will firm specified a Powers system of pneumatic temperature control, including the important dew point control which acts on the chilled water auxiliary cooling used in rooms exposed to the outside. This control (see diagram) utilizes a Powers Water Mix Valve on the ceiling panel chilled water supply and a low limit Submaster Regulator. The Powers Hygrostat measures room humidity conditions and resets the low limit temperature to prevent condensation on panel surfaces, yet allows supply water temperature to be as low as possible for maximum cooling.

Fuel savings in all zones, including those not cooled, are maintained with Powers Day-Night zone controls. A 7-day program clock on the master control panel in the boiler room provides easy switching from day cycle to night cycle. This Powers pneumatic control panel automatically provides a 24-hour-a-day picture of temperature levels in all zones.

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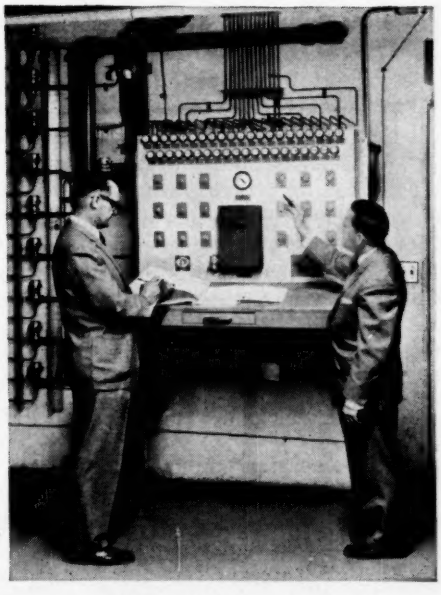

Homewood-Flossmoor Maintenance Superintendent William C. Drews (left), takes readings from the automatic Powers pneumatic control panel.

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What Readers Say:

High Temperature Water Systems

EDITOR,
AIR CONDITIONING, HEATING AND VENTILATING

We have read with great interest Mr. Hallanger's article in the June issue entitled "High Temperature Water Systems". His article was very informative, and we are very glad to see that people are now recognizing that there is no mystery to high temperature water system control. The need for instrumentation and automatic reset merely complicates the job, and many times prevents what might have been a successful job from working properly.

I am in complete agreement with virtually everything that Mr. Hallanger said in his article with one exception. He specifically points out that one should not use electric valve actuators for high temperature water systems as they are not available with a safe margin of ambient temperature rating. Perhaps this is true of most electric valve operators but certainly should not be construed as being true for all electric valve operators. Barber-Colman electric valves have been applied on many high temperature water systems which have been in operation for several years. When put on the right type of valves and with bonnet yokes that properly isolate the valve operator from the heat in the valve body, electric control becomes a very practical approach to this problem. As one can see from the article, a great deal of outdoor reset control is necessary on high temperature water systems, and there is no better combination than an electronic outdoor reset controller, with its adjustable ratio and calibrated set-point dials located in one cabinet, controlling electric valve operators.

W. G. Young

Manager of Engineering
Automatic Controls Div.
Barber-Colman Company
Rockford, Ill.

Winterizing Chilled Water Systems

EDITOR,
AIR CONDITIONING, HEATING AND VENTILATING

In the November, 1960, issue of AIR CONDITIONING, HEATING AND VENTILATING, the article, "Winterizing Chilled Water Systems," was published to show one method of preventing frozen chilled water coils without resorting to draining the chilled water from these coils during cold weather.

As the writer of this article, I have since been asked if a sub-freezing situation has ever occurred in any chilled water system at the Daily News Building during which parallel flow winterizing actually prevented coil freeze-ups. Mr. Rudolf J. Fischer, chief engineer at the News Building, reports that the preheater controls and freeze-up alarm failed on one of the high pressure primary air systems, which operates on a 24-hour daily schedule, during the night last winter when outside air temperature hovered around 20 deg F. Mr. Fischer discovered the next morning that the sprayed water for humidification had turned into icicles on the casing and piping upstream of the chilled water coil. But the chilled water coil itself was completely ice-free and undamaged; and this was accomplished with water circulating in parallel flow through the coil at an entering temperature of only 49 deg.

I would also like to express my thanks to Mr. Fischer of the News Building Corporation and Mr. Ray Duncan of Meyer, Strong and Jones, whose collective desire to find a suitable method for winterizing large chilled water systems led them to work out the practical design of parallel flow winterizing at the News Building.

Harrison D. Goodman

Consulting Engineer
New York, New York
(Editor's Note: Mr. Goodman's latest article appears this month on page 68)

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NEWS OF THE MONTH

DECISION IS REVERSED IN BOILER EXPLOSION CASE

A precedent-setting, 1958 court decision, which ruled negligence on the part of an architect for failure to inspect a new boiler installation that during its initial test exploded and killed a man, has now been reversed by the Louisiana Supreme Court, reports Consulting Engineers Council *Newsletter*.

The accident occurred before the work of the contractor was accepted and was caused by the failure of the deceased plumber to properly install a pressure relief valve on the system. The trial court, and later the court of appeal, held that the widow could recover damages from the architects on the grounds they were negligent in supervising the progress of the work, and also in approving shop drawings which, allegedly, did not show a pressure relief valve as had been clearly required in the original plans and specifications.

In March, of this year, the Louisiana Supreme Court reversed the lower court decisions and relieved the architects of all liability for the accident. The court noted that the plumber himself omitted the pressure relief valve, and that the explosion occurred during a preliminary test of the system, made without notice to either the architects or the consulting engineers. (Engineers had already been relieved of any responsibility because the architect was the prime contractor.) According to the court the architects were not charged with the duty of inspecting the methods used by the contractor or subcontractors, and did not have a duty to inspect the system since they had not been advised it was to be tested. *Had notification been given, there is a strong possibility the lower court decisions would have been upheld,* the *Newsletter* states.

With regard to the second charge, the court concluded the architects were not negligent in failing to note the omission of the relief valve on the contractor's shop drawings. This decision was based on the fact the architect's approval constituted authority to order materials and equipment only.

The case is said to represent a clear vindication of the earlier rulings and indicates that the court understands, generally, the duties and responsibilities of the architcets and the engineers, both with regard to inspection of work and approval of shop drawings. The case does serve, the *Newsletter* concludes, as a warning that the architect and engineer do have major responsibilities in connection with the supervision of construction and approval of installation.

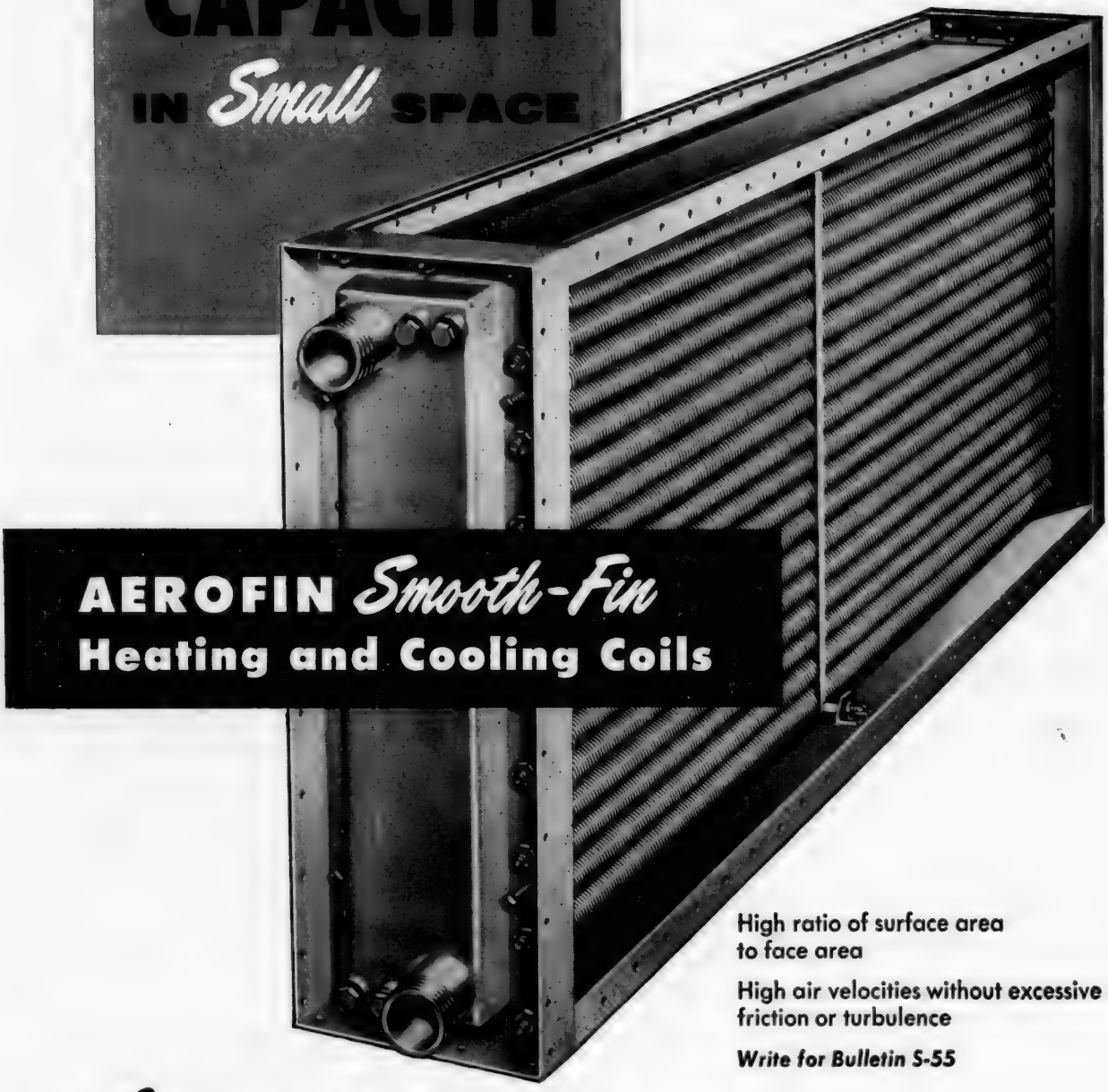
LABORATORY IN THE FIELD: Herbert T. Gilkey, technical director of National Warm Air Heating and Air Conditioning Association, records temperature data at 4-, 30-, and 72-inch levels in New Orleans, La., home, during research into design of heating systems in typical residences in the Gulf area, where high humidities and other unusual climatic conditions occur. Pole at left holds thermocouples. Assisting are Rex K. Martin, Jr., seated at left, and Thomas Jenny, representatives of the Indoor Comfort Bureau of Greater New Orleans, sponsor of contractors' Silver Shield program for that area. Out of this research will be formulated specific standards for the area.

"UPTREND WILL CONTINUE" AGC EXECUTIVE PREDICTS

"Midway through the year, the outlook seems much more definitely hopeful. . . . It is evident that a substantial recovery from the recession has been in progress for the last few months, and the general expectation is that the uptrend will continue at least for the rest of this year, and probably well beyond 1961," James D. Marshall, executive director of Associated General Contractors of America told a Chamber of Commerce conference, June 30.

(Continued on page 12)

BIG CAPACITY IN *Small* SPACE



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High air velocities without excessive friction or turbulence

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ENGINEERING OFFICES IN PRINCIPAL CITIES

"UPTREND WILL CONTINUE"—AGC

(Continued from page 10)

"The largest volume of new construction in history was the 1959 total of $56.2 billion. The $55 billion total in 1960 was the second highest. The AGC forecast made six months ago anticipated for 1961 a volume of new construction totaling $57.275 billion, representing a new all-time high, if realized. With half the year gone, AGC is confident that its moderately optimistic forecast will be fulfilled, at least so far as total volume is concerned, barring an unforeseeable disaster, as the development of a grave international disturbance or a run-away inflation in the domestic economy. Nothing of this sort seems likely at this time."

So far this year, private construction has lagged about 3% behind last year's level, Mr. Marshall said, due to sluggishness in residential building. New public construction, however, is running about 12% ahead, with indications that this level will continue.

HEAT PUMP STANDARD PUBLISHED BY ARI

An ARI certification program for unitary heat pumps will be initiated as soon as test equipment can be installed and contracts and other preliminary details are completed, it was announced by John A. Gilbreath, chairman of the Unitary Air-Conditioner Section of Air-Conditioning and Refrigeration Institute following a recent section meeting.

The program will include unitary heat pumps up to 135,000 Btuh cooling capacity, but will not include reverse-cycle room air-conditioners. It will closely follow, in contractual relationships, procedures, and testing of equipment, the Unitary Air-Conditioner Certification Program, which has been in operation for more than two years. However, because of the more-complicated nature of the equipment, a number of modifications have had to be made in testing requirements.

Like the Unitary Air-Conditioner Program, the Heat-Pump Program will be administered by ARI under the direction of the Unitary Air-Conditioner Section.

As a pre-requisite to approval of the program by the Section, a revised ARI Standard for Unitary Heat Pump Equipment (ARI Standard 140-61) has just been published, Mr. Gilbreath said. The last previous revision, published in 1957, has been completely rewritten to provide a basis for the proposed certification program.

A particular feature of the new standard are the revised rating conditions, which call for standard rating capacities for both summer (at 95 deg F outdoors) and winter (at 45 deg outdoors) operation, and an additional required winter condition rating at 20-deg outside temperature, to cover operation at lower outside temperatures than was called for in the previous version.

Copies of the new Heat Pump Standard are available from ARI, 1346 Connecticut Ave. N.W., Washington, D.C., at a price of 50 cents each.

23-STORY BUILDING COOLED BY PACKAGES

The new 23-story, $15 million, all-electric Atlanta Merchandise Mart, said to be the largest commercial building in the South, is being heated and cooled by packaged heat pumps located around the perimeter of each floor. According to the manufacturer, 440 Fedders Corporation Adaptomatic Heat Pump air conditioners are installed.

The one million square foot Mart, consisting of 400-odd showrooms and 3½ miles of corridors, has been designed to present the most efficient working conditions of any commercial building in the country, according to John C. Portman, Jr., architect and president of the Mart. After consideration of various systems, it was decided by the architect and mechanical consultants to bypass the traditional big-building systems in favor of multiple packaged heat pump air conditioners.

The cost of traditional big-building air conditioning generally runs between 14% and 18% of total construction costs, Mr. Portman said. Savings in piping, tubing, ductwork, motor starters, fans and motors were said to have reduced this percentage substantially. A large savings in engineering man-hours and in simplified structural design must also be credited to use of the packaged units, it was said.

CHAMBER OF COMMERCE GROUP SCRUTINIZING BUILDING CODES

An Advisory Council on Building Codes, composed of representatives of architects, engineers, trade associations and model code organizations, has been organized in Washington, D. C. The sessions, held May 18-19, were sponsored by the Chamber of Commerce of the United States.

Council Chairman William G. Kirkland, assistant vice-president of American Iron and Steel Institute, New York City, said at a closing luncheon that there is an urgent need to clarify code affairs to the general public and that the council had come together to advise the National Chamber on the degree to which progress has been made; to give its opinion on the steps to be taken in formulating, enacting, and administering codes that can lead to further progress, and to provide general information to the public that will cast a true light on the subject.

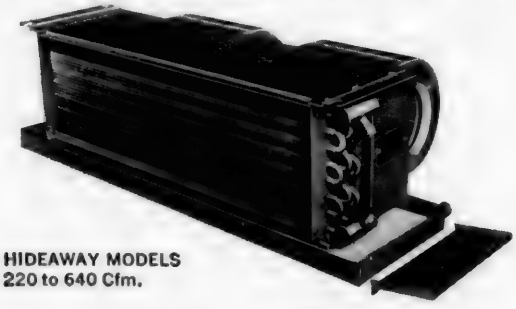
He said he was sure the group would draw up "the most clear statement on code affairs that has ever been promulgated."

William B. Tabler, chairman of American Institute of Architects Committee on Building Codes, said he was wholeheartedly behind

(Continued on page 14)

McQuay

individual room SEASONMAKERS



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Before you specify or install, insist on comparing the McQuay Seasonmaker with all others for quality construction, quietness, appearance and performance. Your McQuay representative will give you complete Seasonmaker information, or write to McQuay, Inc., 1619 Broadway N.E., Minneapolis 13, Minnesota.

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AIR CONDITIONING • HEATING • REFRIGERATION

CODES SCRUTINIZED

(Continued from page 12)

the approach taken by the council. George N. Thompson, former Chief of Codes and Specifications for the National Bureau of Standards said "the true course for progress is not sensationalism but steady, hard, first-rate effort by the best minds in the field."

The next meeting of the full council will be held in September. In the meanwhile, several task groups will meet to attack different aspects of the problem and draw up authoritative statements on them.

VENTILATING STANDARDS SLATED FOR REVIEW

Standards work on building code requirements for light and ventilation will resume later this year by a reorganized sectional committee of American Standards Association, New York, N.Y.

The American Public Health Association, the American Society of Heating, Refrigerating and Air-Conditioning Engineers and the Illuminating Engineering Society have asked ASA to consider recommendations for an enlarged sectional committee, new administrative sponsors and a well-defined scope.

A four-member steering group of the ASA A53 Sectional Committee proposed reorganization of the committee at a recent meeting. The group expressed concern over the lack of standardization work in the field, the last effort resulting in an American Standard on light and ventilation requirements in 1946.

Tentative plans call for the formation of two subcommittees later this year, each to prepare drafts for minimum requirements for daylight and electric light and specifications for natural and mechanical ventilation and air-conditioning. A target date of February, 1962, was set for the initial sectional committee meeting.

FIRE LOSSES INCREASING; EQUIPMENT IS INADEQUATE

Industry losses in major fires rose sharply during the past year, National Fire Protection Association reported.

More than $87,800,000 worth of industrial plants and facilities in the United States and Canada was destroyed in 133 "large loss" fires in 1960, according to the international fire safety organization. This was an increase of almost $29,500,000 in dollar cost and 20 in number over the previous year.

In analyzing the 1960 major industrial fires, NFPA points out that these 133 fires in almost all instances started as minor outbreaks, just as did more than 40,000 other industrial fires in the United States and Canada. However, they were not stopped before they became major losses.

Both construction weaknesses and absence of protection equipment like automatic sprinkler and alarm systems were the principal reasons why minor fires spread out of control. Automatic sprinkler protection would have prevented a substantial majority of the large loss industrial fires.

URGES GAS UTILITIES TO RENT AIR CONDITIONERS

Gas utilities have been urged to exploit their financial strength by leasing gas air conditioning equipment to consumers who may hesitate to make outright purchase because of its higher initial cost.

David W. Hoppock, vice-president of Bryant Mfg. Co., Indianapolis, Ind., put forth this suggestion recently in a series of speeches at AGA Regional Sales Conferences. The plan, developed by Kenneth Kessler of City Gas Company of Miami, was tested last year with highly successful results.

The appeal of this arrangement is largely to the commercial market and the professional man. The user acquires his air conditioning on a ten year lease. The monthly payments work out to a modest amount and are handled as operating expense for tax purpose. This is a very common business practice today.

In last year's experiment, the lease plan involved seventeen installations, each using Bryant 3-ton gas units. Different types of customers were chosen, including a doctor, dental laboratory, home, restaurant, hotel, and factory office. Doctors and lawyers, because of their excellent credit rating, are considered good prospects, and they usually own their buildings.

Mr. Hoppock outlined the basic pricing structure as follows: The utility absorbs the cost of the unit, including a $100 contingency reserve on each sale; adds overhead, profit, and financing charges; and bills the customer a monthly charge of under $30, in this case.

PLASTIC PIPE GETS BOOST FROM FHA MATERIALS BULLETIN

The Society of the Plastics Industry, Inc., has announced that the Federal Housing Administration will now accept NSF approved Polyethylene Pipe and Fittings meeting the requirements outlined in the FHA Use of Materials Bulletin UM-31, dated March 1, 1961.

Acceptable uses outlined in Section III of Bulletin UM-31 include house service lines; drop pipe in jet and suction wells; well-to-house piping, and other potable cold water services outside the foundation walls of the building. Bulletin UM-31, which is presently being disseminated to about 300 FHA field representatives throughout the country, includes sections on Materials; Handling and Storage; Installation procedures, and System Pressures. It also incorporates the required markings on Insert Fittings used with polyethylene pipe which show compliance with the Proposed Tentative American Standard on Insert Type Fittings.

(See News Briefs, page 128)

Problem: Paint jobs ruined by airborne dirt in spray booth

This plant needs make-up air! If the exhaust fans in your paint shop remove air faster than you replace it, they cause a vacuum. The vacuum sucks in dirt and dust every time a door or window is opened. Your plant needs make-up air...a supply of new air to replace exhausted air and cancel out vacuum.

Without make-up air, you get a chain reaction of vacuum problems. Violent cross drafts...Infiltration of dirty air or fumes from outside, and from one plant section to another ...Heat loss...Unhealthy workers... Low morale...Costly absenteeism.

Solution: install separate fans to supply make-up air. They cancel out the vacuum, give your plant balanced ventilation. These fans should be part of a complete make-up air system that tempers and cleans the incoming air.

For technical help on make-up air, see your Consulting Engineer. Or call in Sturtevant application engineers. They're experts in handling air...whether you want to move it, heat, cool or clean it. Mail coupon for booklet on make-up air. J-08709

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You'll have a new conception of how *uniformly good* radiator valves, traps and vents can perform when you make the job Marsh all the way through.
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The Marsh Radiator Valve is *truly* packless—not just *called* packless. This valve has no "packing" whatever... instead, the ingenious Marsh annular mechanical seal that keeps it drip tight throughout its far longer life.
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Yes, the Marsh way is the sure way...Valves, Traps, Vents, F & T Traps, designed, built and tested to give lasting satisfaction in the Marsh tradition. Ask for up-to-date Heating Specialties Catalog 76-H.
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THE BIG CONDENSING UNITS WITH THE FANDAIRE DESIGN

FANDAIRE AIR-COOLED CONDENSERS

Now Fandaire Condensing Units are available in a full range of sizes from 3 HP through 90 HP – complete with the Fandaire air-cooled condenser and single, dual or multiple compressors.

Units use the original circular design that incorporates exclusive Yuba fintube with its high heat-dissipating efficiency. Every degree of temperature drop is fully used as the circular design approaches true counterflow—where the coolest air is in contact with the coolest gas. Its powerful fan pulls air in from the sides where it is as much as 4° cooler than air from below. Warm used air is pushed up and away. As air is captured from *any* direction, *any* breeze increases the unit's capacity.

The Fandaire Condensing Unit has the highest ratio of capacity to actual size of any condensing unit on the market today.

Installation is easy—no field assembly required. Factory assembly is included in the price. Get full details today on the *big* condensing units with the Fandaire design. Special quotes on custom units.

3-30 HP (single compressor)
10-60 HP (dual compressor)
60-90 HP (multiple compressors)

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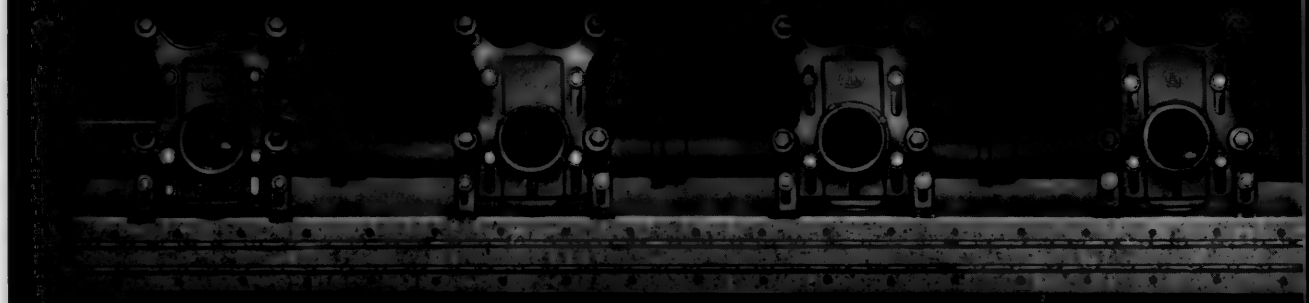

ALL-NEW ZURN
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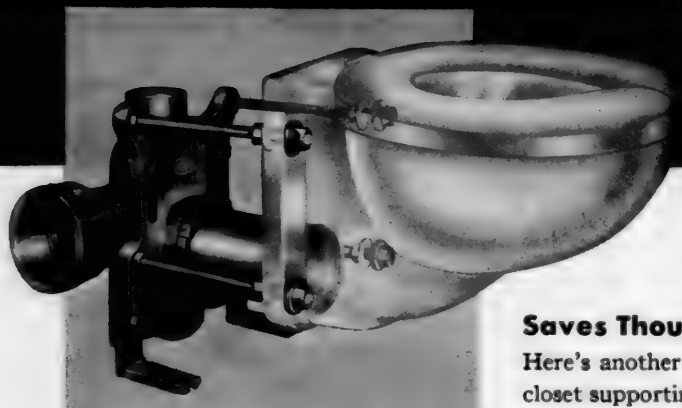

UP TO 19 WALL

ZURN "MONOLITHIC" SYSTEM - - -

the only behind-the-wall system that makes possible long-run batteries of off-the-floor siphon-jet water closets without expensive modifications or weakening of structural slabs. Adjusts to all standard closet roughing heights and drainage line pitches.

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Patents and patents pending
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Saves Thousands of Dollars in Structural Work

Here's another "first" from Zurn creative engineering - - a wall closet supporting system so startlingly different that it saves you thousands of dollars in structural work alone! Now, for the first time . . . you can install long batteries of off-the-floor siphon-jet water closets without costly and time-consuming modifications to structural slabs - - *even when installed on the most modern, thin reinforced monolithic flat plate slabs.*

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Unique Zurn design places entire supporting and drainage system above the slab in one continuous, unbroken plane - - *with no interference to critical reinforcing members.* You save the expense of costly floor fills, depressed slabs, forming, fabricating, and on-the-job alterations normally associated with specifying and installing conventional supports.

ZURN

Monolithic

system®

With deck located in center of battery, 9 wall closets can be installed on each side

MONOLITHIC" SYSTEM ELIMINATES COSTLY FLOOR FILLS, MODIFICATIONS TO STRUCTURAL SLABS . . . MAKES POSSIBLE - -

CLOSETS IN A BATTERY ON ONE STACK!

Accommodates All Manufacturers' Fixtures

Only *one* face plate needed to fit all manufacturers' siphon-jet wall closets. Adjusts to all roughing heights and drainage line pitches - - *even where no floor fill is required.* Entire system designed for simplified installation, widest range of adjustability, and manufactured to last the life of the building.

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Unlike floor-mounted installations, all-new Zurn "Monolithic" Systems require none of the special structural design work needed to form, arrange, and tie-in reinforcing members at each point where floor-mounted closet bend sleeves ordinarily pierce slab. You not only save money by staying above the slab . . . but you also gain the additional benefits of clean, sanitary off-the-floor restrooms - - economically possible only with Zurn "Monolithic" Systems. *The first . . . and still the very best!*

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Hydromechanics Div.
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Gentlemen: Please send me your new engineering data manual describing the Zurn "Monolithic" System. I am a ☐ structural engineer; ☐ mechanical engineer; other_____

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Quiet, vibration-free performance is essential when motors are installed in areas where noise must be held to a minimum . . . in hospitals, churches, schools, office buildings, restaurants and similar locations where quiet is needed or wanted.

Such installations have created a need for larger polyphase motors that whisper while they work. Wagner has met this need by expanding its line of polyphase resilient mounted motors to include standard ratings through 10 hp.

You certainly have applications that call for a smooth running motor, cushioned by resilient mountings. To make sure they're quiet, specify Wagner Polyphase Resilient Mounted Motors. Only Wagner can provide an entire range of ratings through 10 hp.

Constant research and development have kept Wagner up front in electric motor design for more than 65 years . . . made the name Wagner one you can depend on in choosing electric motor drives.

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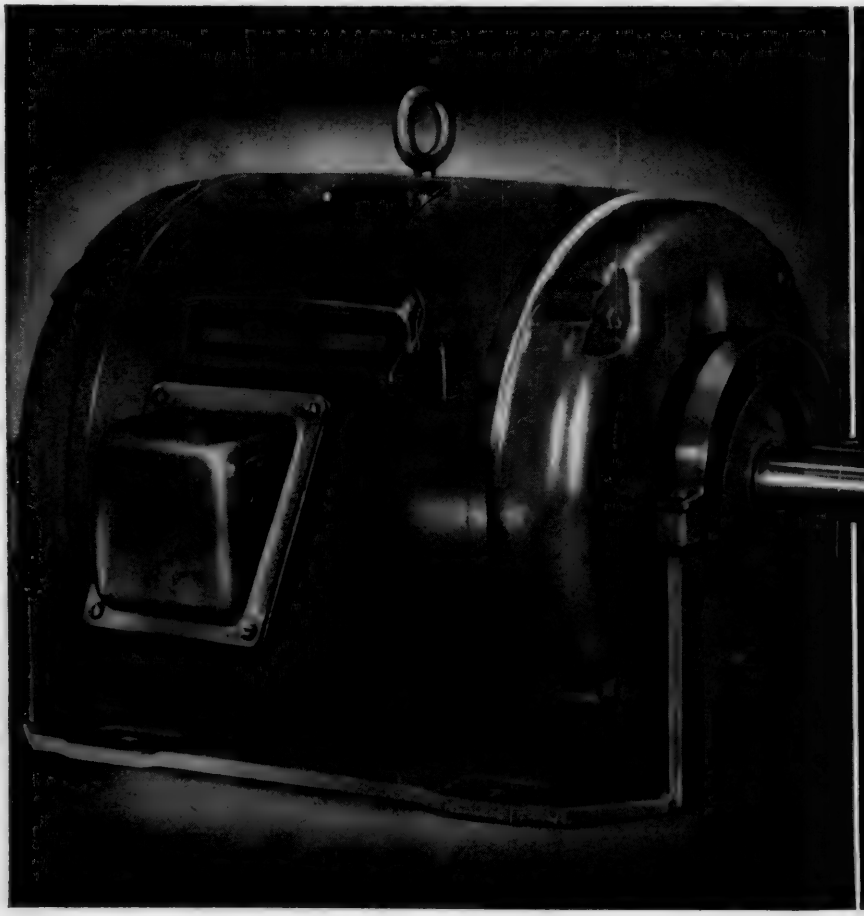

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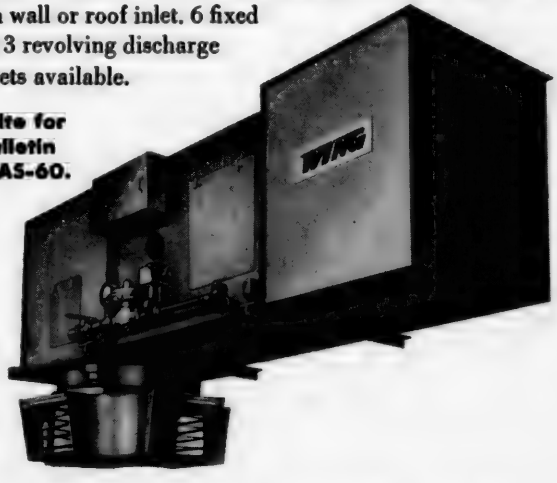

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In THE EMPIRE STATE BUILDING, New York, Mr. Donald Gibson, Staff Engineer, says Sloan Flush Valves have caused practically no maintenance problems since the opening of that fabulous building.

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Because the Sloan ROYAL is acknowledged as the world's most successful flush valve, attempts have been made to imitate some of its most important features. But why gamble with substitutes when you can plan for the life of the building confidently with Sloan? Specify performance-proven, time-tested Sloan Flush Valves.

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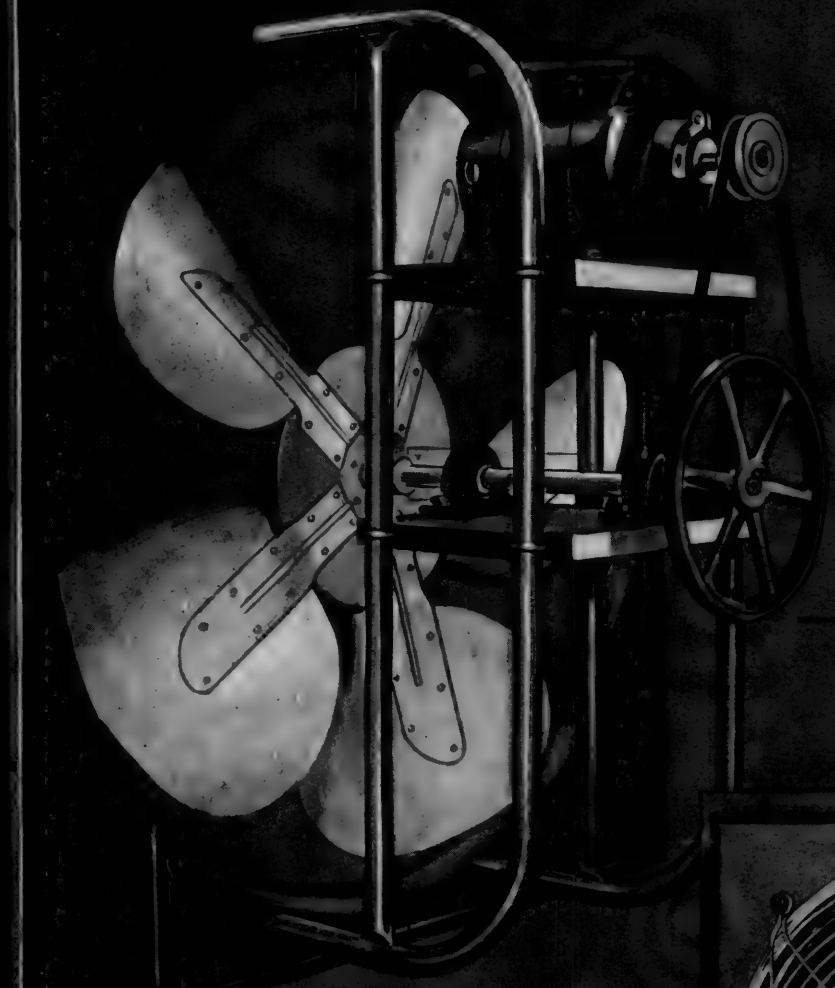

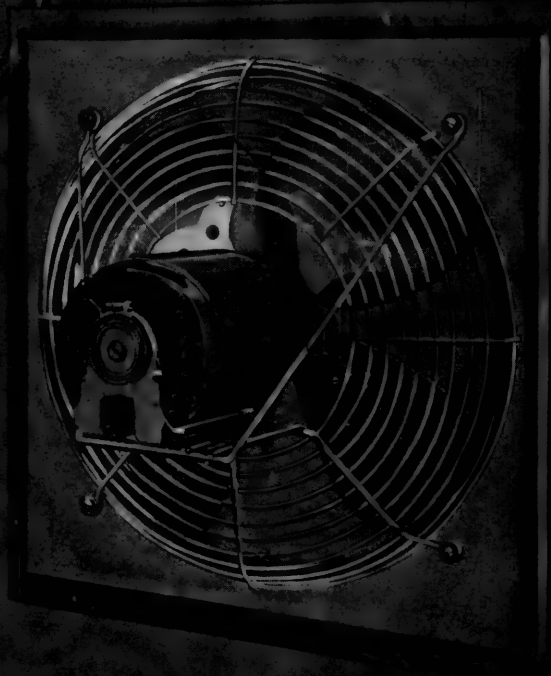

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Bethcon galvanized steel sheets permit long spans, minimum supports

Strong and rigid—because they're steel—Bethcon galvanized sheets form up into strong and rigid ductwork which requires a minimum number of supporting brackets.

In addition, a Bethcon galvanized steel sheet is just right for easy shopwork . . . not too hard, not too soft. That's because we use a special annealing cycle which gives the sheet an ideal balance of ductility and strength.

Bethcon's zinc coating is second to none for its refusal to flake or peel off. Bethlehem's continuous galvanizing process bonds zinc to steel so tightly that even when the sheet is doubled back on itself, the coating stays put. Hemming without puckering or wrinkling is no problem with Bethcon sheets.

You can specify Bethcon galvanized sheets in a wide variety of gages, with either plain open-hearth or copper-bearing (Beth-Cu-Loy) steel for the base metal. We'll be glad to furnish any details you need. Just get in touch with our nearest sales office.

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—for trouble-free performance . . .
for every refrigerant control application

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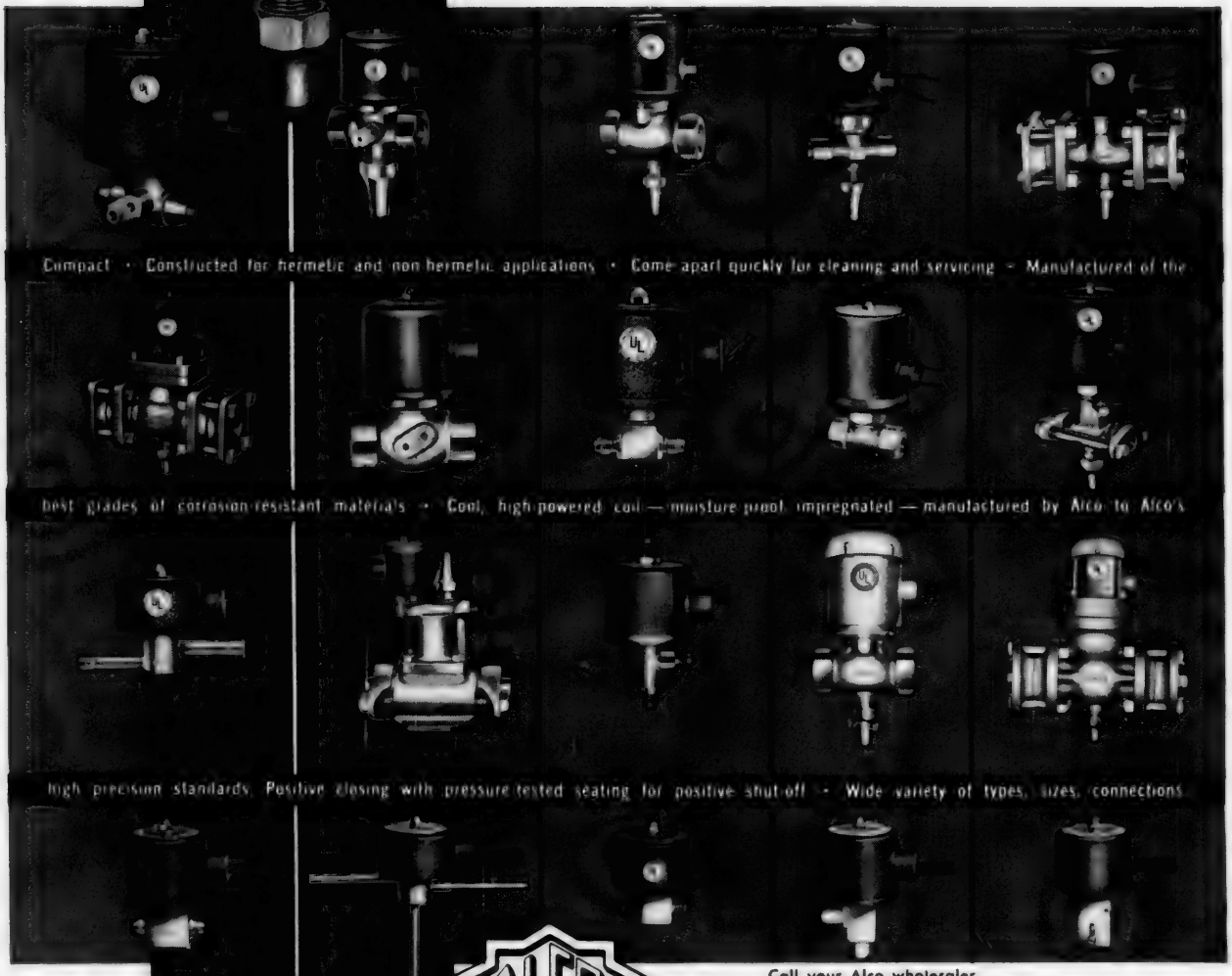
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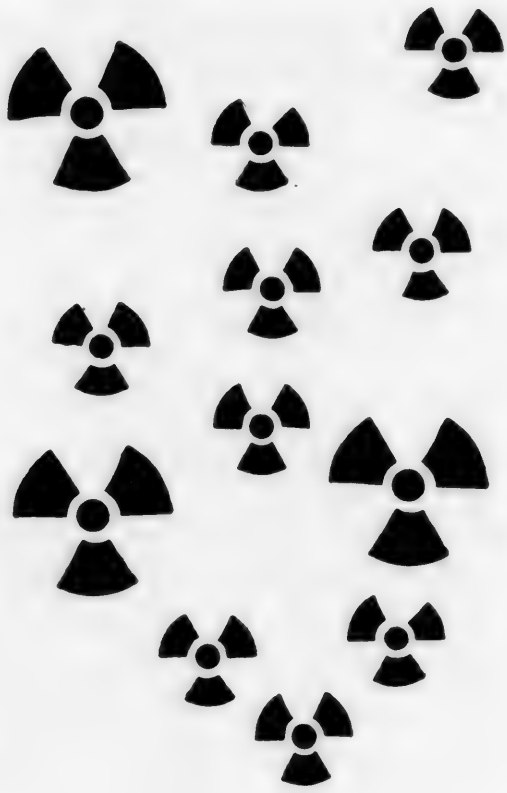

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underground hot pipe insulation

has been installed in
12 Atomic Energy Commission plants in the United States
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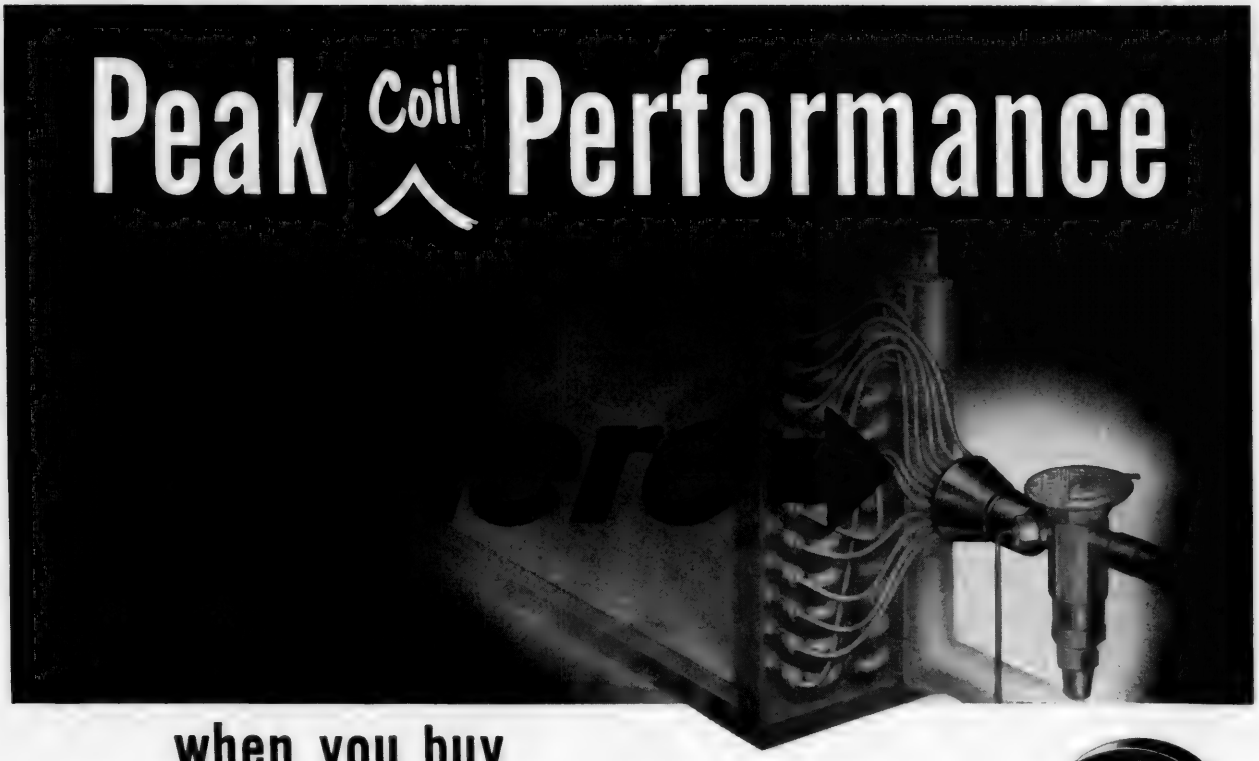
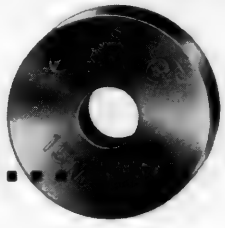
Affiliate of Barber Oil Corp. & Standard Oil Co. of California • Distributors in Principal Countries of the World

Peak Coil Performance



when you buy SPORLAN Refrigerant Distributors with the Versatile Interchangeable Nozzle...



The distributor nozzle orifice is the key factor in creating the necessary velocity and turbulence to maintain a homogeneous mixture of liquid and vapor for equal distribution to all circuits of the evaporator.

Provides the desired flexibility to handle variations in evaporator applications . . . changes in load, temperature and refrigerants.

Distributor may be installed in any position.

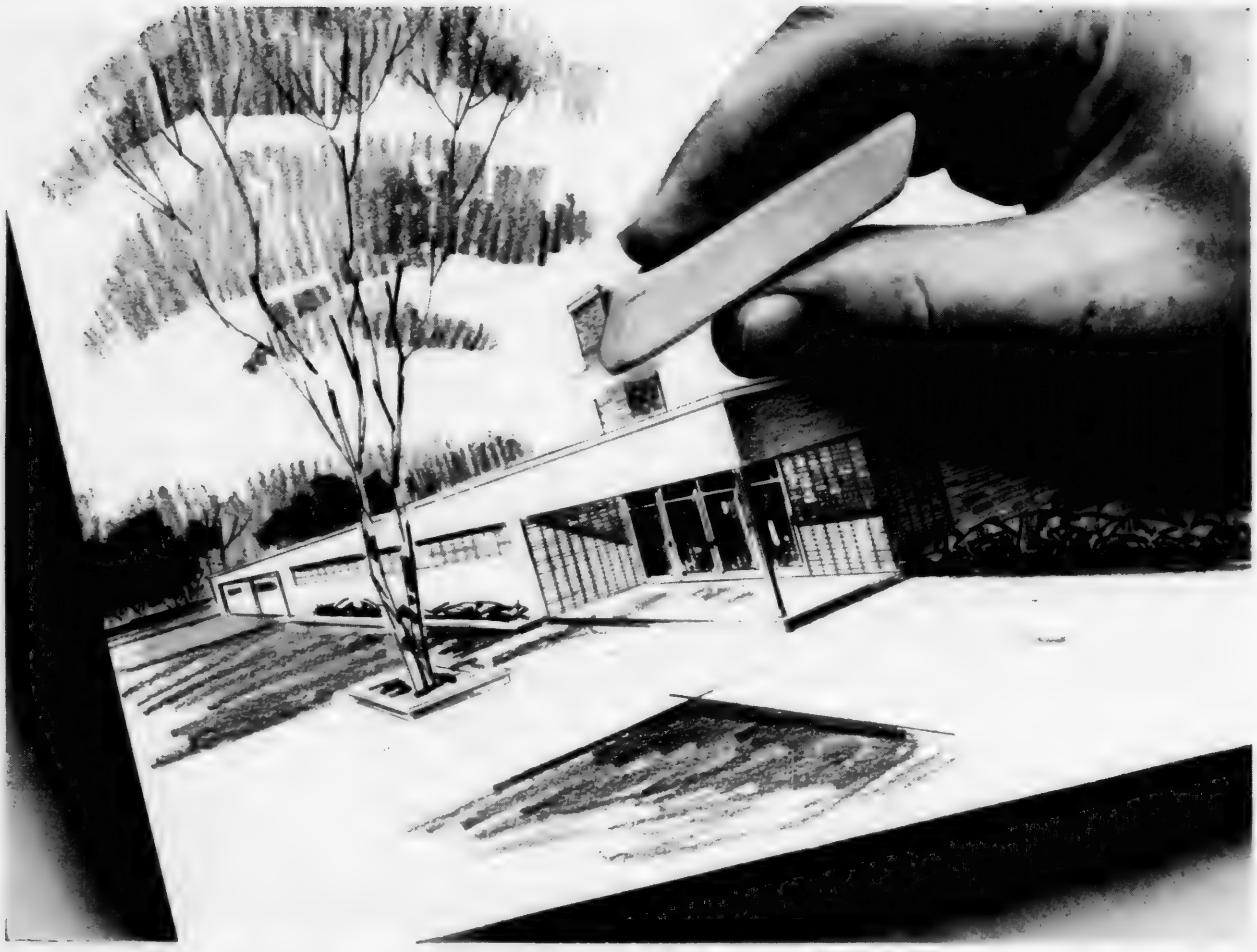
Permits simplified inspection of solder joints and connecting tubing from distributor to evaporator.

Sporlan Refrigerant Distributors available in any combination of circuits and capacities . . . flare, sweat or flange connections . . . brass, steel or aluminum bodies.

And only the Sporlan line offers brass body distributors with auxiliary side connections developed especially for hot gas defrost, hot gas by-pass and reverse cycle (heat pump) applications.

Get all the facts, *write for Bulletin 20-10.*

SPORLAN VALVE COMPANY
7525 SUSSEX AVENUE ST. LOUIS 17, MISSOURI
EXPORT DEPT. 85 BROAD STREET NEW YORK 4, N. Y.



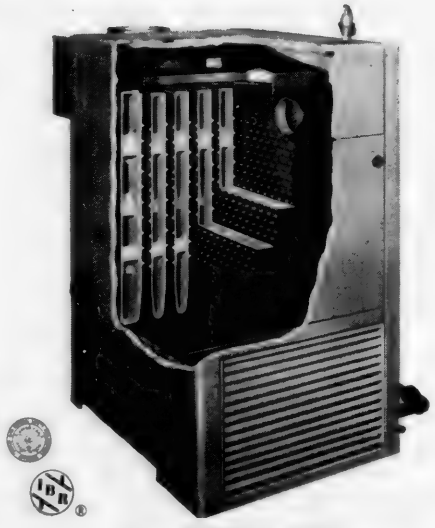
FORGET THE CHIMNEY WHEN YOU SPECIFY A WEIL-McLAIN TYPE "J" GAS BOILER

The Weil-McLain Type "J" Cast Iron Gas Boiler does not need a high chimney which breaks up the smooth sweep and flow of modern architecture...nor is a draft fan necessary. It conforms to A.G.A. venting requirements...products of combustion can be expelled with only a 5 foot vent riser beyond the draft hood openings. Where building conditions require a longer vent, design and sizing data are available from Weil-McLain.

Other highlights of "J" Boiler design

1. A.G.A. approved efficiency of 80%.
2. Compact design saves boiler-room space—up to 50%.
3. A.G.A. approved for all gases.
4. Electronic controls and pre-wired control panels engineered as part of unit.
5. No refractories, motors, fans, tubes or water treatment.
6. Can be assembled at any stage of building construction.
7. 33 sizes in 500 gross sq. ft. increments permit close sizing.

Send for Bulletin C-297. For oil boiler information see Engineers' Product File or Sweet's Architectural File.



Type "J" Gas Boiler
Net I=B=R Ratings, steam and water, 360,100—3,354,000 BTU/hr.

WEIL-McLAIN CAST IRON BOILERS

WEIL-McLAIN COMPANY • Dept. BB-81 • MICHIGAN CITY, INDIANA

McDONNELL
Flow Switches

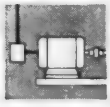
FS4 Series Flow Switch Mounted in a 2 inch Tee

Do you know how many jobs these switches can do?

Look at the FS4 Series Flow Switch illustrated here. What you see is a compact, well-built switch that either makes or breaks a circuit (as required) when liquid flows or stops flowing. Yet in this versatile device you have both the most economical way and the most positive way of starting or stopping a signal, an alarm, a motor, a metering device—anything electrically operated. Just to highlight a few uses:—

to actuate a signal light—signal an attendant to make the right moves in operating valves, pumps and the like—signal him when flow stops in a water cooled compressor, water cooled bearing and so on.

to sound an alarm—when flow stops in a process system or in any water cooled devices.



to start or stop motors—start pumps in sequence in multiple stage flow systems; start standby pumps; stop automatically controlled units if cooling water system fails; stop compressors in cooling systems when flow stops. These are *control* functions, and almost endless.

to start or stop automatic burners—start a booster heater when water draw occurs; stop burner if flow is improperly retarded; make sure of circulation in a boiler before burner is permitted to start.

to actuate metering device—open valve in chemical feeder line; start mixing in secondary line whenever flow starts in primary line.

Think it over! Some of these uses may suggest some related problem the FS4 can solve for you right now. Notice the facts about its construction and service range opposite.

McDONNELL & MILLER, *Inc.*, 3500 N. Spaulding Ave., Chicago 18, Ill.

Doing One Thing Well

Coupon brings bulletin

It covers design, construction, electrical ratings and dimensions. Points out many typical applications.

Please send me a copy of Flow Switch Bulletin FS1.

COMPANY _____

ADDRESS _____

CITY, ZONE, STATE _____

BY _____

Mail to: McDonnell & Miller, *Inc.*, 3500 N. Spaulding Ave., Chicago 18, Illinois

McDonnell quality throughout:

Compact switch with positive snap action. Removable cover and two knockouts for easy wiring. Phosphor bronze sylphon seals assembly leak-tight from line. Paddle made in segments to fit any pipe from 1" through 3". FS4 series, illustrated, is for maximum working pressure 100 psi; maximum temperature, 300° F., in types as follows:

FS4-3 Single pole, double throw switch. Opens and closes two separate circuits with flow. Closes and opens same two circuits with no flow.

FS4 Closes with flow, opens with no flow.

FS4R Opens with flow, closes with no flow.

Underwriters' Listed

● Model E-2 available for larger pipe sizes and pressures to 150 psi.

Spring St., L.A. *like* Wall St., N.Y.C.

knows the soundest investment in valves

New headquarters of UNITED CALIFORNIA BANK
Los Angeles

Again, JENKINS VALVES are the bankers' choice

Taller, perhaps, but there's no *finer* bank building in New York than the new Head Office of United California Bank on Spring Street in Los Angeles' financial area. Headquarters for 122 offices in California, this 370,000 sq. ft. building is an outstanding example of the excitingly modern architecture and superb engineering and construction which draws many building experts to Southern California for a "look-see."

There's an expected "California difference" in the design and decor of this bank. But a significant fact is that, like so many of the great bank buildings in New York and other cities, the valves that control the piping systems bear the same *"Diamond and Signature"* trademark.

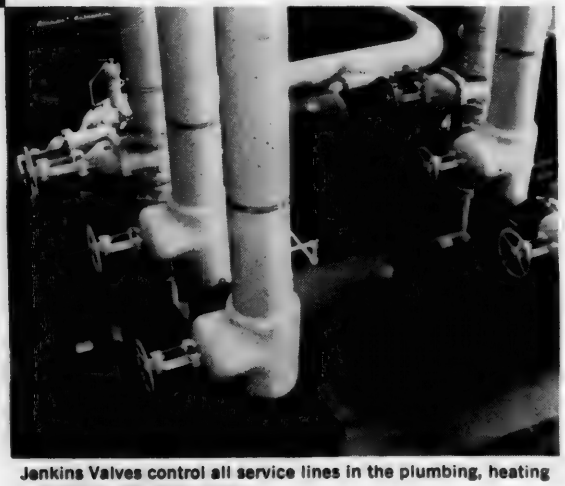
Obviously, California bankers and their architects and engineers agree with their contemporaries everywhere about the soundest investment in valves. To assure a building-lifetime of trouble-free, economical valve service, they call for JENKINS.

Why should *you* settle for less . . . especially when Jenkins Valves *cost no more* than other good valves? Specify "Jenkins Valves," for almost a century *the standard of quality*. Jenkins Bros., 100 Park Avenue, New York 17, N. Y.

Architect: CLAUD BEELMAN & ASSOCIATES; *Mechanical Engineer:* JOHN C. FREEMAN; *Mechanical Contractor:* MEHRING & HANSON CO.; *General Contractor:* C. L. PECK CONSTRUCTION AND REALTY CO. . . . all of Los Angeles

JENKINS
MOST TRUSTED TRADEMARK IN THE VALVE WORLD
VALVES
JENKINS SINCE 1864
Jenkins Bros

AVAILABLE FROM LEADING DISTRIBUTORS EVERYWHERE



Jenkins Valves control all service lines in the plumbing, heating and air conditioning system

SO QUIET

water supply lines stay quiet when Josam shock absorbers are installed

Water hammer in supply lines is noisy . . . disturbing and destructive to pipe connections, valves and gauges. Why risk it happening on any job . . . when you can prevent it so easily and so economically? When you install Josam Shock Absorbers, water hammer disappears . . . pipe lines become as quiet as a kitten . . . and you provide permanent protection against expensive shut-downs and repairs. There is a type and size for every water hammer condition—commercial, industrial, residential*.

They are simple in construction, troubleproof, dependable — no springs or bellows to stick, no diaphragms to wear out, no liquids to replace. Thousands upon thousands in all types of installations have demonstrated proven performance over the years. The cost is so little compared to the possible damage prevented that they should be included on every job! For further information, write for Manual "SA."

**Josam "Genie" Residential Shock Absorbers are molded of DuPont Delrin®.*

Josam Series 1480 Shock Absorber

JOSAM MANUFACTURING CO.

General Offices and Manufacturing Division • Michigan City, Ind.

REPRESENTATIVES IN ALL PRINCIPAL CITIES

West Coast Distributors

JOSAM PACIFIC CO.

765 Folsom Street San Francisco 7, Calif.

JOSAM PRODUCTS ARE SOLD THROUGH PLUMBING SUPPLY WHOLESALERS

Manufacturers and Representative in Mexico—HELVEX, S. A., Mexico City

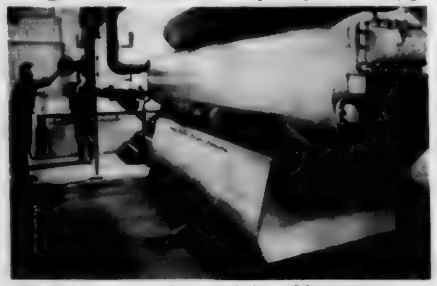
New general offices of Swanson Brothers in Omaha, Nebraska. Air-conditioned efficiently and economically by gas-operated Carrier absorption refrigeration. Architects & Engineers: Leo A. Daly Co. Mechanical Contractor: J. J. Hanighen Co. Both of Omaha, Nebraska.

Swanson insured low operating costs with GAS and CARRIER absorption refrigeration

Swanson Brothers—nationally known in the foods industry—chose gas-operated Carrier absorption refrigeration to air-condition their beautiful new general office building in Omaha, Nebraska.

The basis for their choice was *lower costs*, with the unbeatable fuel economy of gas and the simplicity and trouble-free operation of the Carrier absorption unit. With no major moving parts, it quietly and efficiently uses steam from a gas-fired boiler to provide chilled water for cooling.

Carrier has solved the problem of sustained efficiency at partial loads in absorption cooling. An exclusive Carrier solution-capacity-control gives partial load efficiency unsurpassed by any other type of cooling system.



Trouble-free is the word for this 140-ton capacity gas-operated Carrier absorption unit at Swanson building. Says Wendell Mitchell, Building Engineer, "I really think this system is great. All I have to do is check it now and then. Never a bit of trouble."

You can keep air conditioning costs low and efficiency high, with gas-operated Carrier absorption refrigeration. For details call your local Gas Company, or write Carrier Air Conditioning Company, Syracuse 1, N. Y. *American Gas Association*

FOR HEATING & COOLING GAS IS GOOD BUSINESS!

AIA No. 30-C-1

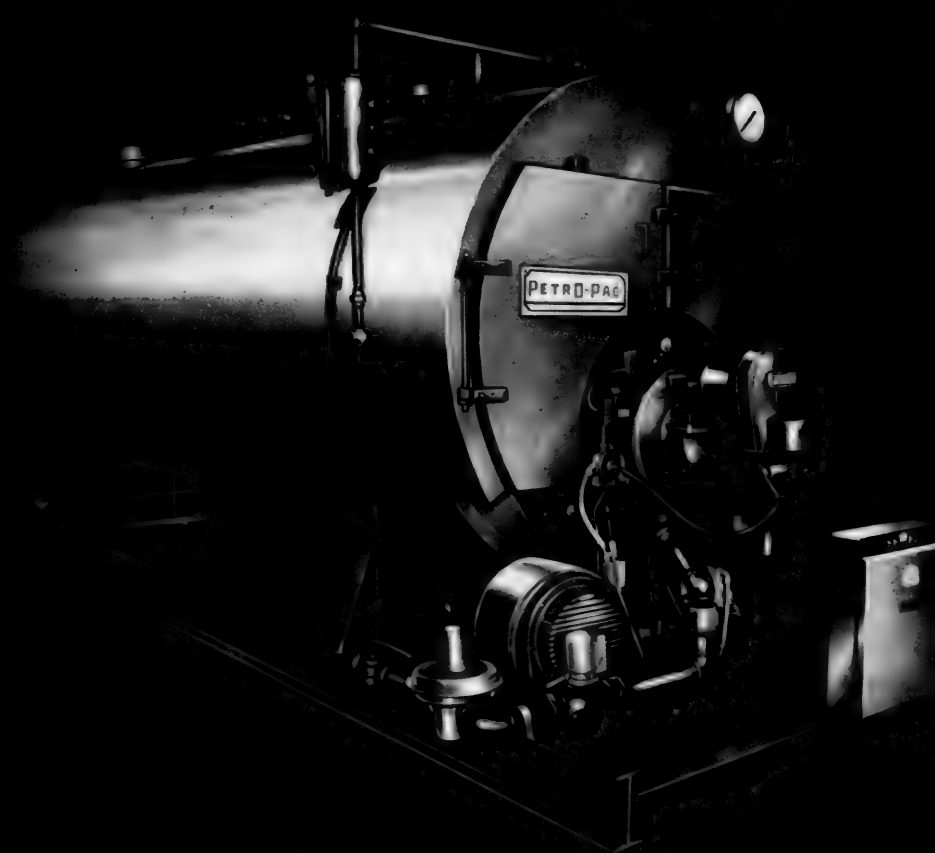
It's NEW GET MORE FACTS

SEND FOR...

If you've got your

EYE

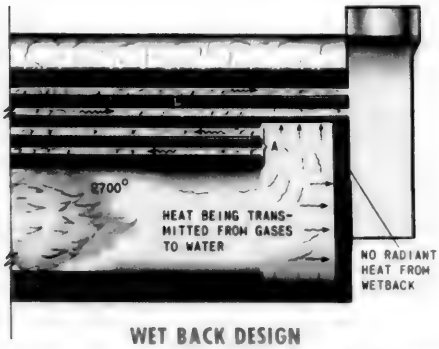
on Economical
Packaged Heat...



3-Pass Wet Back
Fire-Tube Construction

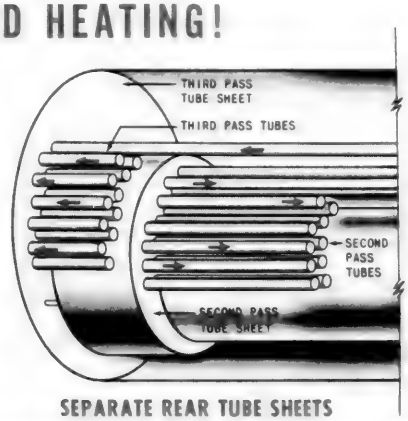
for gas, oil or gas-oil firing

WHY THE PETRO PAC IS A STRIKING ADVANCE IN PACKAGED HEATING!



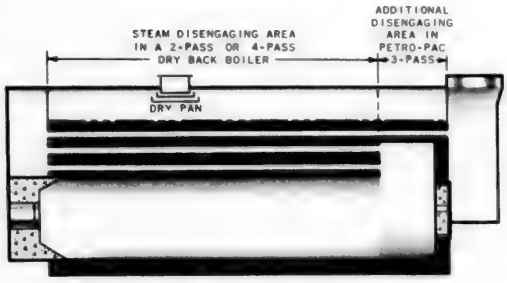
WET BACK DESIGN

The cylindrical rear turnaround is completely immersed in water. This insures that all surfaces transfer heat to boiler water and that no heat is radiated to the rear tube sheet. There's no refractory to maintain. No refractory baffles to leak.



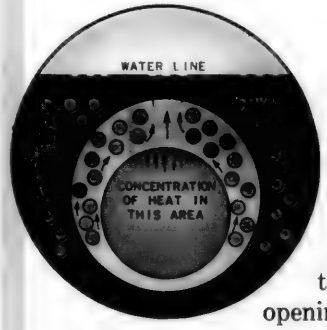
SEPARATE REAR TUBE SHEETS

Because of different gas temperatures, tubes in the second and third pass expand and contract at different rates. But since these tubes terminate in separate tube sheets, stress and strain on ligaments are more nearly equalized in each tube sheet.



ADDITIONAL STEAM DISENGAGING AREA

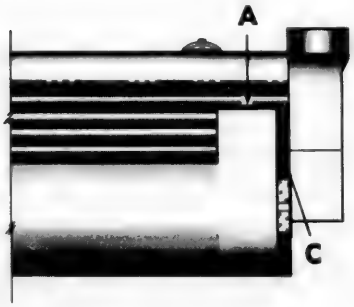
Water extends over rear turnaround to rear of boiler, giving more disengaging area than do some dry back boilers. The dry pan on all steam generators is located under the nozzle outlet.

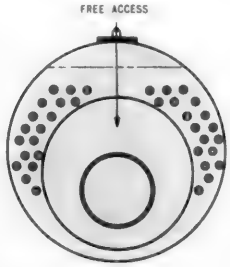


FREE FLOW WATER CIRCULATION

There are no tubes above the furnace in the third pass. The opening between the tubes in the second pass permits free flow of water around and above the furnace tube — the hottest part of the boiler. Neither are there any tubes below the furnace, permitting free circulation of water around the furnace tubes. This provides adequate space between furnace and tubes . . . insures free flow of water.

EASY ACCESSIBILITY TO WATERSIDE SURFACES FOR CLEANING AND MAINTENANCE





There are no tubes over the rear turnaround at designation "A". This makes the furnace and rear turnaround easily accessible for cleaning through a convenient manhole. The flat surface at designation "C" on the rear of the turnaround can also be cleaned through the manhole. Easy maintenance of waterside surfaces means longer boiler life.

AIA No. 30-C-1

TEAR HERE FOR FILING

Wrings More Heat from Your Fuel Dollar—in Less Space!

Minimum of 80% Combustion Efficiency... Total Fuel Combustion

Especially designed for more economical and efficient heating in small-to-big commercial and industrial buildings ... process load installations.

The new Petro Package Generator is a striking advance in packaged heating . . . combines maximum fuel economy with even greater Petro dependability. It incorporates in the 301 Series a compact 3-pass wet back boiler and the famous Petro forced draft sealed combustion Rotary burner . . . burning low-cost heavier oils . . . in a single completely integrated package. Models Series 300 also available for light oil, utilizing Power-Blast burner.

Top to bottom, inside and out, the Petro Package Generator gives MORE money-saving features than any other generator.

MAXIMUM FUEL ECONOMY Specially designed to fit the outstanding characteristics of the Petro Rotary burner, the 3-pass fire-tube construction affords maximum heat extraction and quick transfer of heat to boiler water . . . insures *over 80% combustion efficiency* . . . faster heating action.

CLEAN, QUIET OPERATION Flame starts clean, burns clean . . . without soot or fume. That's because *total combustion* is achieved through precise control of fuel feed and air supply. The unit operates quietly, too, because it's completely free from flame pulsation, the cause of annoying vibration.

NO STACK The forced draft sealed combustion chamber creates its own draft, so it needs no costly chimney. Only a vent is required.

LOW STANDBY LOSS There's no refractory rear-end to absorb, retain and waste heat. Furnace heating surfaces are exposed to direct radiation for fast heat transfer. In addition, sealed combustion prevents infiltration of cold air during "off" periods.

LOW ELECTRICAL CONSUMPTION Electrical costs are reduced. That's because total electrical horsepower of burner and blower is substantially lower than in the case of many other generators.

ECONOMICAL AND EASY TO INSTALL The unit is completely pre-assembled, pre-wired at the factory . . . ready to set in place and connect. Factory-tested before shipping.

SIMPLE TO MAINTAIN Tubes can be quickly and easily inspected or cleaned by opening hinged front doors, without disturbing the burner. Doors are constructed of heavy gauge steel and lined with insulation to minimize radiation. Access door at rear provides easy inspection of rear turnaround surfaces exposed to heat. The circular rear turnaround can be inspected or cleaned through a conveniently located manhole.

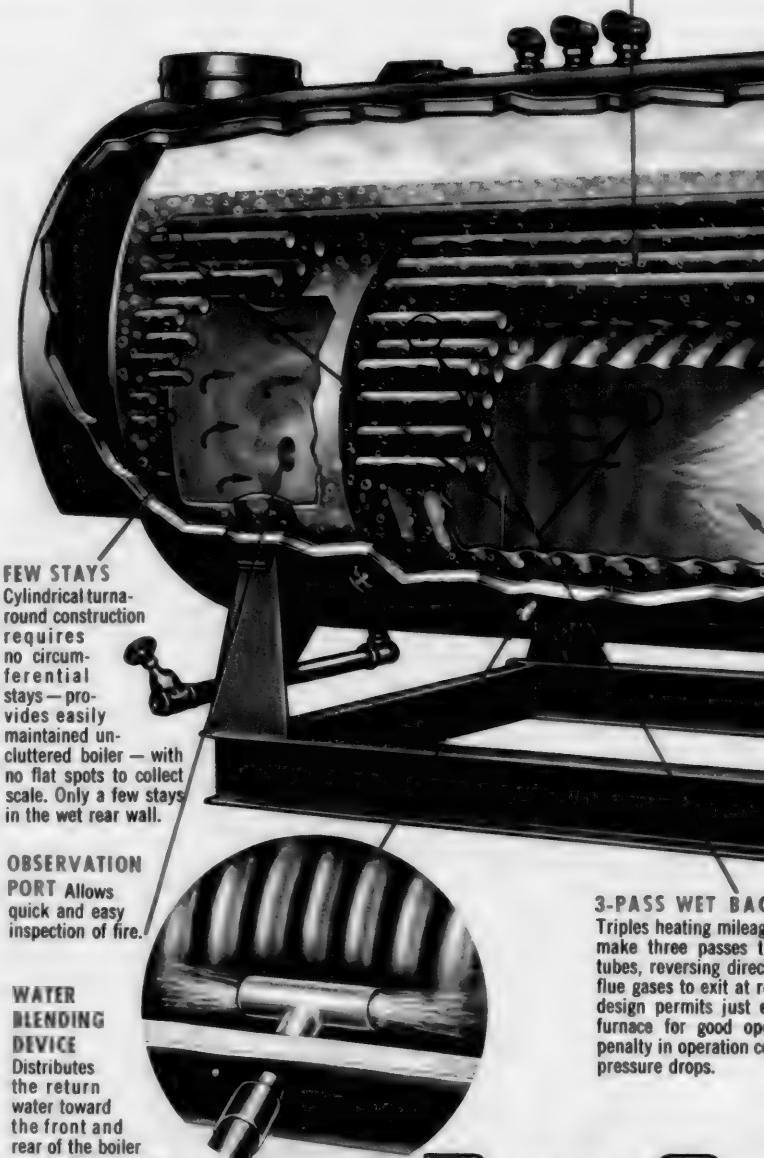
LITTLE SERVICING Combustion problems are reduced because the blower, primary air fan, cup and nozzle are matched exactly to the pressure drop through the boiler for the maximum firing rate. Thus, less adjusting and servicing is required.

ONE-SOURCE PURCHASE Undivided responsibility is guaranteed for the complete package . . . boiler, burner and all accessory equipment.

Here's the Inside Story on the Fuel-

COMPLETELY WATER-COOLED REAR FURNACE Another fuel-saving characteristic of this remarkable heating package . . . with many features that add up to less maintenance and operating costs!
The rear turnaround is completely immersed in water, insuring minimum heat radiation to the rear wall, more surface to absorb heat, lower temperature of flue gases entering second pass of tubes, no refractory to radiate heat on tube sheet, no refractory baffles separating the passes of the boiler to leak and cause higher stack temperatures.

FIRE TUBES A feature of Petro's Three-Pass de is that each pass of tubes has a separate tube sh Because the temperature of the gases is differe each tube pass, there are different rates of expan and contraction of the tubes in each pass. This ec izes the forces being exerted on each tube sheet eliminates stresses and strains due to uneven ex sion and contraction of varying temperature t terminating in a single tube sheet. All tubes are r and beaded and are 2" in diameter in the sm sizes and 2½" in the larger sizes.



FEW STAYS Cylindrical turnaround construction requires no circumferential stays—provides easily maintained uncluttered boiler—with no flat spots to collect scale. Only a few stays in the wet rear wall.

OBSERVATION PORT Allows quick and easy inspection of fire.

WATER BLENDING DEVICE Distributes the return water toward the front and rear of the boiler causing it to blend with boiler water before contacting any heated surfaces. This minimizes thermal shock.

3-PASS WET BAC Triples heating mileag make three passes t tubes, reversing direc flue gases to exit at r design permits just furnace for good op penalty in operation c pressure drops.

PETRO

T.M. Reg. U.S. Pat. Off.

3

-Saving 301 Series Petro Package Generator

esign
sheet.
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nsion
equal-
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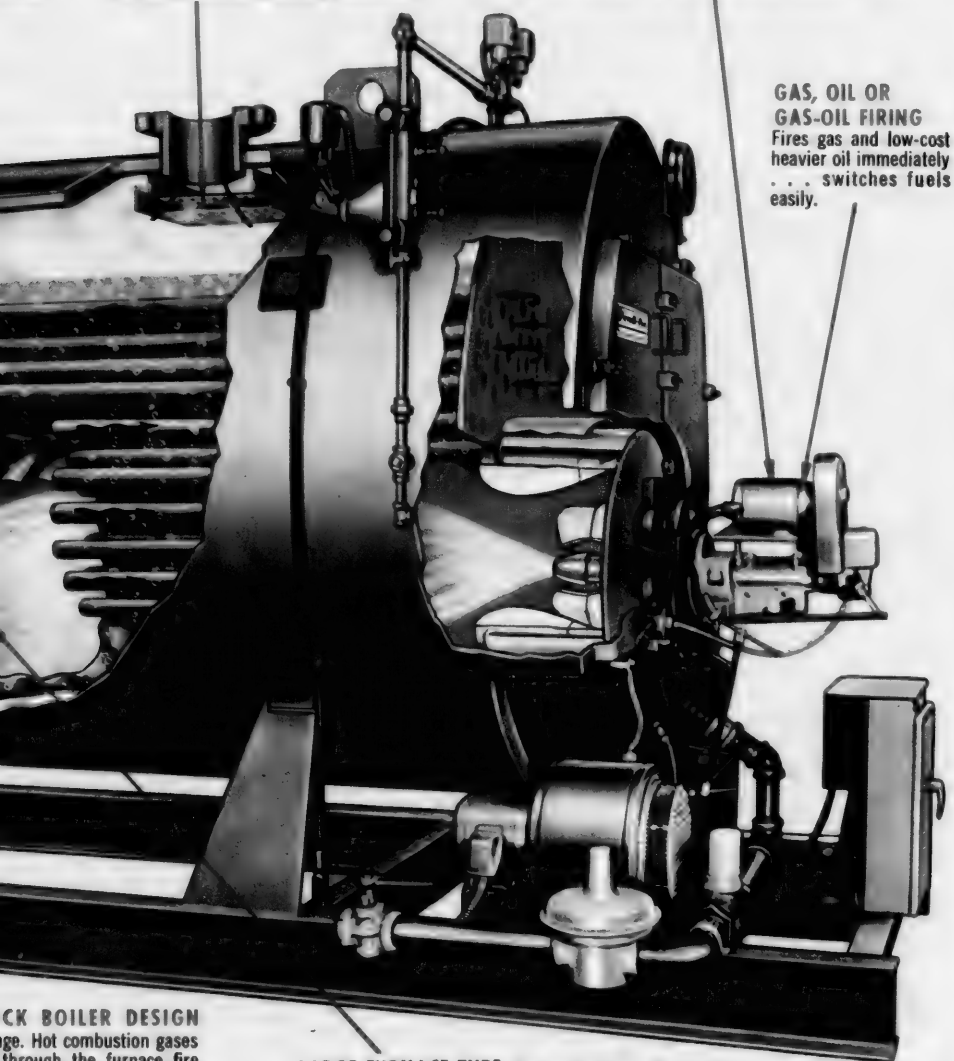
tubes
rolled
maller

"INSTANCOIL" WATER HEATING COILS Instantaneous, indirect (tankless) hot water coils are available for quick, hot water supply. (Optional)

INTEGRAL STEAM SEPARATOR Mounted in the boiler below the steam nozzle, it insures dry steam at the boiler outlet even under less favorable operating conditions.

FORCED DRAFT SEALED COMBUSTION ROTARY BURNER Permits highly efficient pressure firing. Only accurately metered air can enter the furnace through the burner. Precise control of fuel feed and air supply insures highest combustion . . . clean, smokeless operation. Gas phase of burner incorporates multiple jets. Gas is discharged into air stream behind vaned burner head, providing uniform mixture of air and gas before entering the combustion chamber.



GAS, OIL OR GAS-OIL FIRING Fires gas and low-cost heavier oil immediately . . . switches fuels easily.

CK BOILER DESIGN
ge. Hot combustion gases through the furnace fire ction twice, which causes rear of boiler. Three-Pass enough pressurization in peration but imposes no costs because of excessive

LARGE FURNACE TUBE The relatively large furnace diameter of the Petro Pac Three-Pass boiler exposes more primary heating surface to the radiant effect of the flame . . . insures that combustion takes place before the flame enters the rear turnaround. This — plus wet back — insures that the second pass tube sheet will be subjected to flue gases at a low temperature.

Makers of quality heating and power equipment since 1903

3170 W. 106th Street, Cleveland 11, Ohio

(In Canada, 80 Ward Street, Toronto, Ontario)

Standard Equipment

[illegible]

No Postage Stamp Necessary If Mailed In the United States

BUSINESS REPLY MAIL
FIRST CLASS PERMIT NO. 2501 CLEVELAND, OHIO

PETRO
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Cleveland 11, Ohio

Postage Will Be Paid by Addressee

NOW 3 "GENETRON" PLANTS TO SERVE YOU!

New "Genetron" plant at Elizabeth, N. J. now on stream.

Above: General Chemical's brand-new "Genetron" plant in Elizabeth, New Jersey has a capacity of more than 10,000 tons of "Genetron" per year. Its output will serve consumers throughout the Northeast. This large new plant is the third "Genetron" facility serving industry. It supplements production at Danville, Illinois, and Baton Rouge, Louisiana. These three highly efficient, big-capacity plants are three good reasons why General Chemical is your *dependable* source for highest quality fluorocarbon refrigerants and aerosol propellants. Be sure—always specify "Genetron."

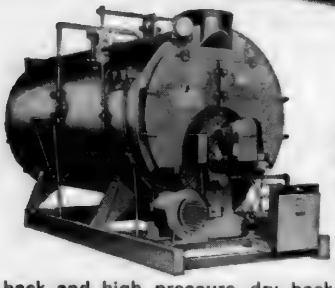
Other "Genetron" production centers at Danville, Illinois

. . . and at Baton Rouge, Louisiana.

Allied Chemical

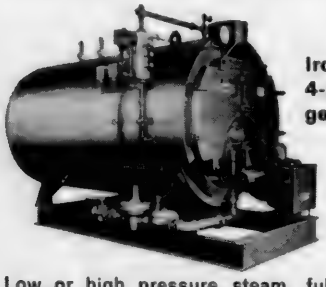
GENERAL CHEMICAL DIVISION

40 Rector Street, New York 6, N. Y.



IronFirepak 2-pass generator

Low pressure steam or hot water, full wet back and high pressure dry back designs. Size range, low pressure 50 to 600 BHP; high pressure 30 to 600 BHP. Light oil or gas in all models. Residual oil from 50 BHP. Gas-oil all sizes.



IronFirepak 4-pass generator

Low or high pressure steam, full wet back, no refractory baffles. Light oil, gas or gas-oil. Size range 30 to 100 BHP high pressure; 50 to 100 BHP low pressure.

WIDE RANGE to fit varying conditions of all heating and power applications

CAPACITIES: 10 to 600 BHP, low pressure steam or hot water and 30 to 600 BHP high pressure steam and hot water.

FUELS: Residual oil, No. 2 or light oil, gas and gas-oil.

TYPES: 3-pass steel firebox generators, 2-pass and 4-pass Scotch marine package generators.

HEATING AND AIR CONDITIONING
AIRCRAFT COMPONENTS AND EQUIPMENT
MISSILE AND AIRCRAFT GYROSCOPES
ELECTRONIC EQUIPMENT
CONTROL INSTRUMENTS

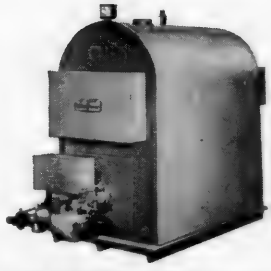
THE IRON FIREMAN

Iron

IronFirepak is the name of a complete family of generators designed around a service-proved firing system with exceptional performance

The IronFirepak generator line varies greatly in size and design in order to provide models that meet the many different power and heating requirements with efficiency and precision. The different design types, however, have many outstanding qualities that are common to all. They all deliver better than 80% thermal efficiency. In all models the boilers are designed to fit burner firing characteristics. All are exceptionally economical, in fuel, in maintenance, in space requirements, in installation. All are of rugged construction, built to the highest standards in the industry.

Most models are complete units, with operating and limit controls factory installed and tested, delivered at the site ready for service connections. No high stack required—merely an exhaust vent.



IronFirepak forced draft steel firebox generator

Extremely compact, highly efficient design is made possible by the Iron Fireman WhirlPower burner, which requires no combustion supporting refractory; no secondary air system. Sizes, 10 to 60 BHP. Gas, light oil or dual-fuel.

IronFirepak steel firebox generator with atmospheric gas burner

Operates on normal gas line pressure; minimum electrical requirements. Delivers rated output equal to same boiler with power gas or oil firing. Sizes, 10 to 60 BHP.

Send coupon for full information and specifications

Fireman®

Iron Fireman Mfg. Co., 3131 W. 106th St., Cleveland 11, Ohio
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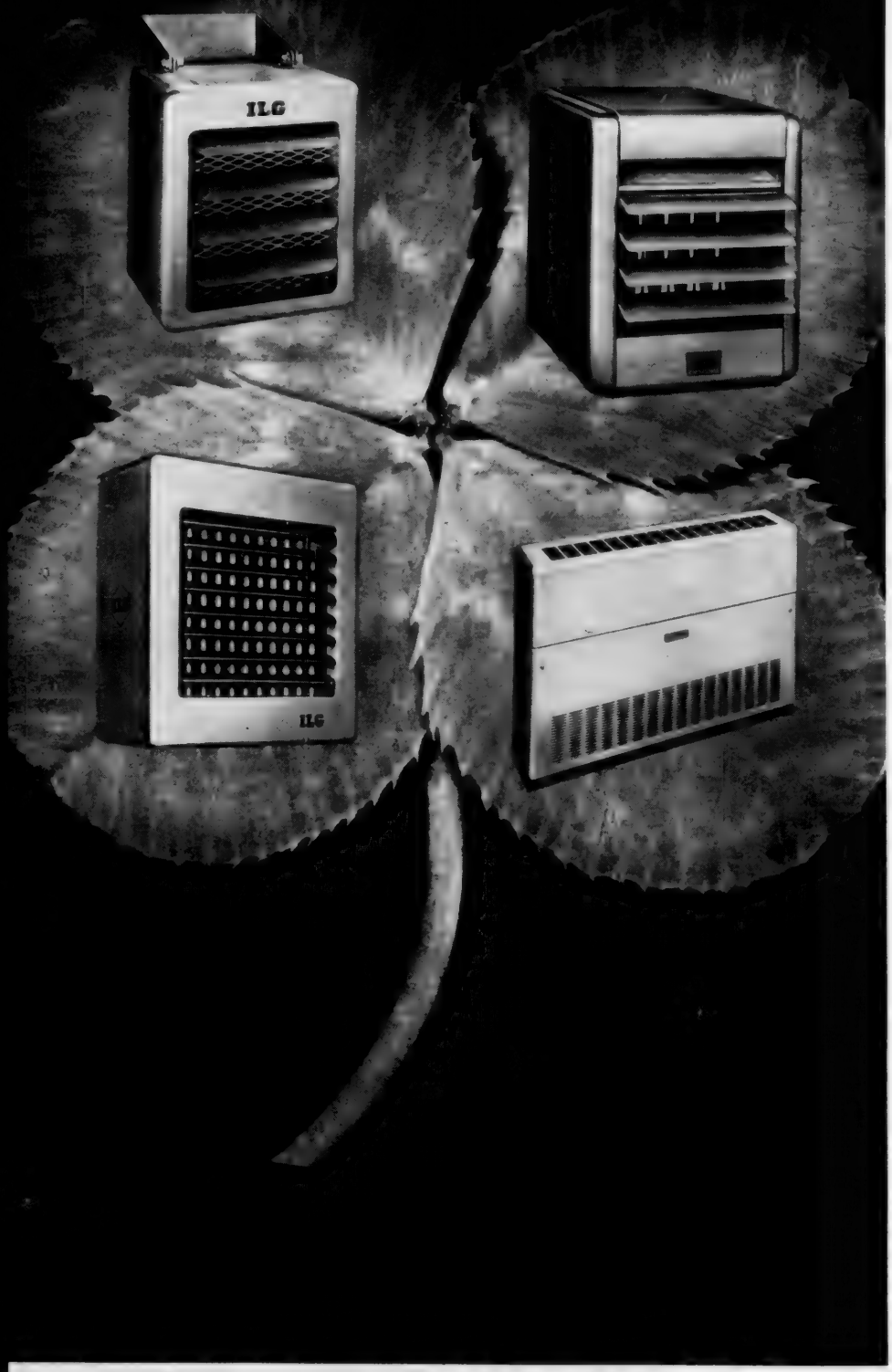

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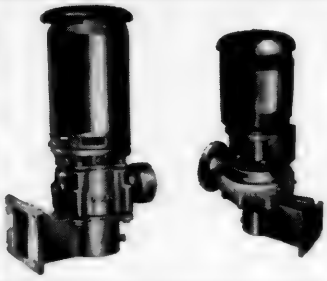
For many years Aurora Centrifugal Pumps and APCO Turbine Type Pumps, and Aurora Condensate Return Units have been serving a broad variety of heating and air conditioning applications with maximum dependability and operating efficiency. Applications include: condenser circulation, boiler feed, cooling towers, air conditioning systems, hot water circulation, and many special operations.

These Aurora Pumps and units are available in many different types and capacities for every type and size of operation. They are quality built for long, trouble-free operation. When maintenance is necessary, repairs can be made quickly and easily to get the pumps and system back in operation fast.



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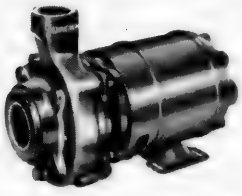
Especially applicable for OEM Equipment . . . Vertical mounting close-coupled design for maximum compactness . . . minimized space requirements . . . simplified, low suction mounting . . . optional discharge arrangements . . . low NPSH. Capacities to 1800 GPM and heads to 320 feet.



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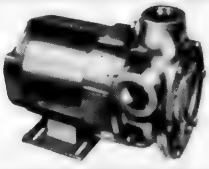
11 packaged sizes . . . stainless steel seals for maximum corrosion resistance . . . stainless steel motor shaft . . . cast bronze impeller . . . self-venting with vertical discharge . . . low NPSH. Capacities to 450 GPM and heads to 140 feet.



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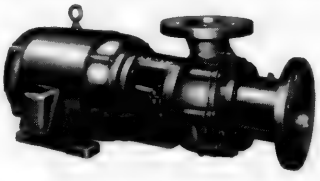

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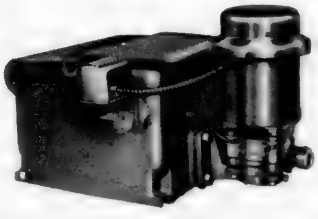
With self-venting vertical discharge . . . interchangeable mechanical seal or packing inserts . . . low NPSH . . . unique suction spool arrangement. Capacities to 1800 GPM and heads to 320 feet—also available with flexible coupled drive.



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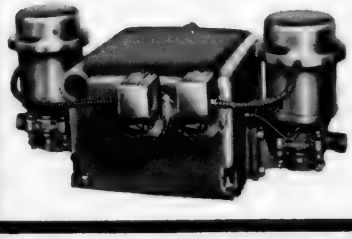
Utmost compactness . . . cast iron receiver . . . mechanical seals . . . close-coupled . . . low return . . . complete unit ready for installation of lead lines. Capacities to 15,000 EDR—20 PSI. Also available as Type AR with APCO Turbine Type pumps—capacities to 10,000 EDR—pressures to 80 PSI.



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For high capacity or heavy duty applications . . . broad flexibility . . . cast iron receiver . . . low return . . . mechanical seals standard . . . packing boxes on pumps optional when desired. Capacities to 150,000 EDR—pressures to 125 PSI.

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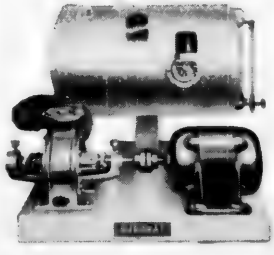

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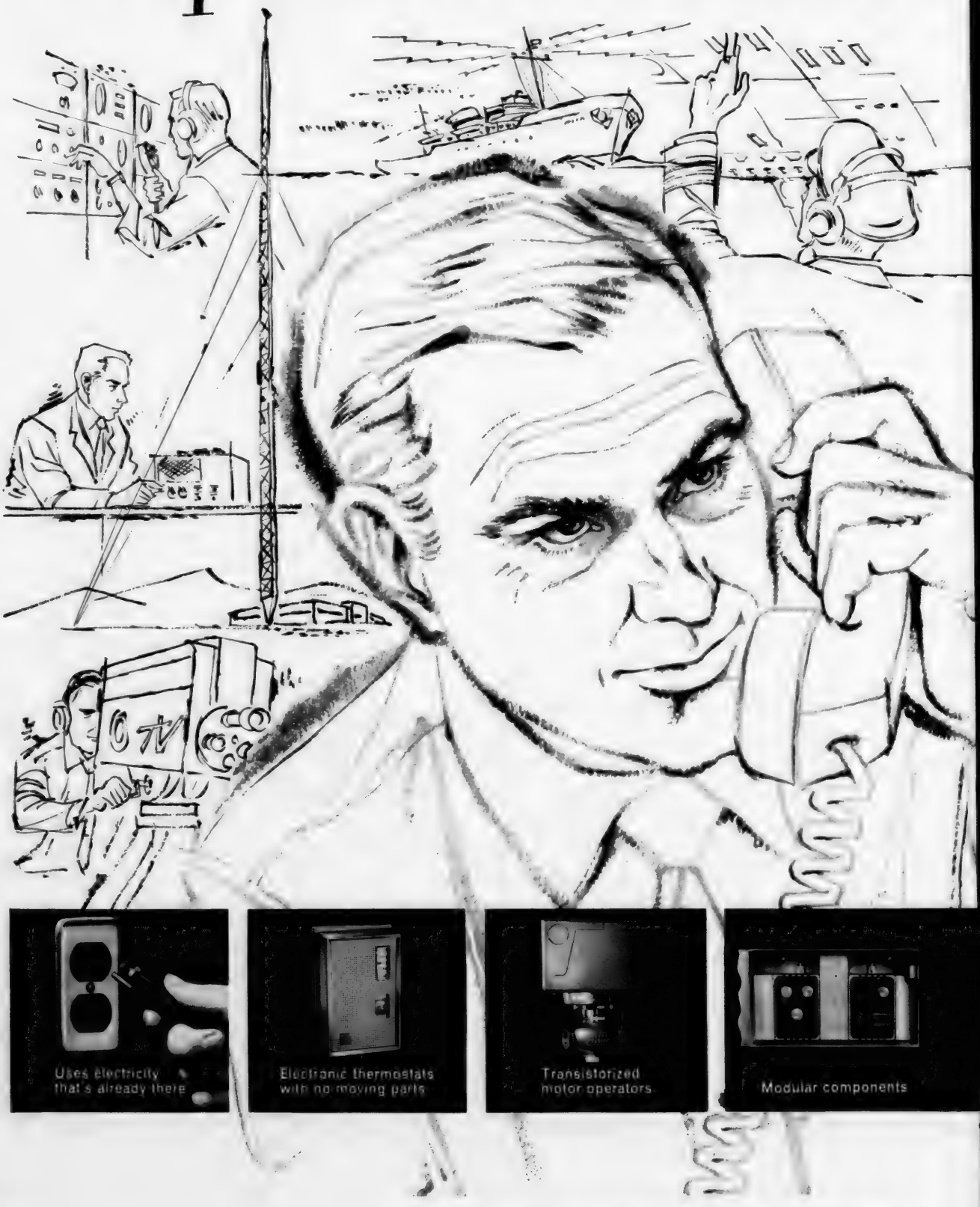
Uses electricity that's already there
Electronic thermostats with no moving parts
Transistorized motor operators
Modular components

is "Communications"

...only logical that it be electric-electronic!

Whenever you use or rely upon communication systems such as the telephone . . . intercom . . . dictating machine . . . or radio, reliable electric and electronic circuits are working for you.

Temperature control is a form of communications, too — whether a thermostat automatically corrects the position of a valve or damper, or a supervisor "reads" on a remote control panel the temperature in any area of a building.

It makes every bit as much sense to use electricity and electronics for temperature control, as it does for other forms of communications — it is fast, accurate, and economical.

Barber-Colman "Electrionic" control systems actually are much less complex than most other electric-electronic communication systems you use; simpler than a radio, for example. This insures the utmost reliability and simplicity and ease of maintenance. Here are the key advantages:

1. "Electrionic" control uses electricity which is already in the building.
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4. The reliability of all the components is comparable to that you experience with the finest commercial communications systems.
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6. Size of the building doesn't matter — in fact, the larger the building, the greater the benefits of the low maintenance and instantaneous operation of "Electrionic" systems.
7. System design assistance, installation, supervision, and service are provided by the nationwide Barber-Colman organization.
8. The finest that money can buy.

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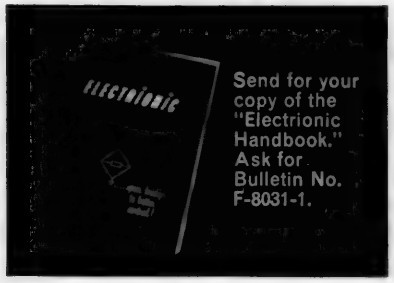

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When you need quality steel pipe *in a hurry*, order USS National Pipe from your local National Tube distributor.

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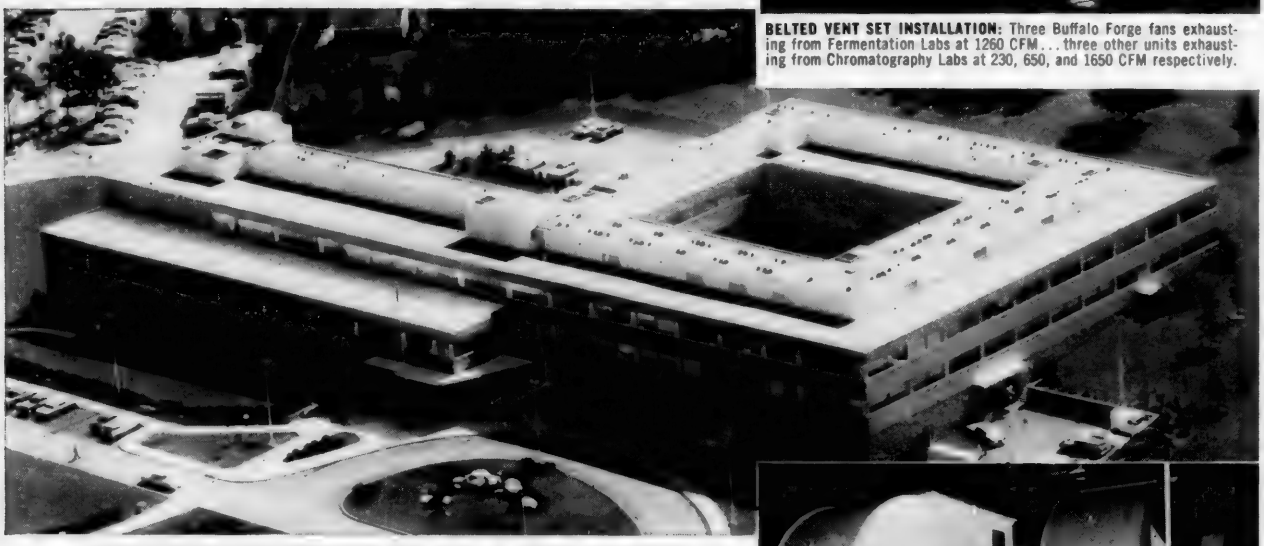
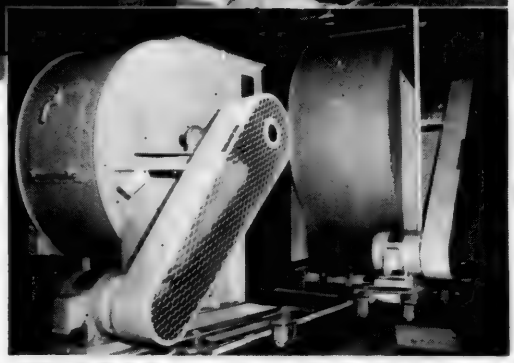
HEALTHY 'BUFFALO' ATMOSPHERES HELP ...PFIZER'S FIGHT

BELTED VENT SET INSTALLATION: Three Buffalo Forge fans exhausting from Fermentation Labs at 1260 CFM... three other units exhausting from Chromatography Labs at 230, 650, and 1650 CFM respectively.



New Medical Research Laboratories of Chas. Pfizer and Co., Inc. at Groton, Connecticut, a modern three-story facility staffed by more than 400 scientists, technicians and supporting personnel engaged in such specialized fields as medicinal chemistry, chemotherapy, macrobiology and fermentation research. Air conditioned and ventilated throughout with Buffalo Forge equipment.



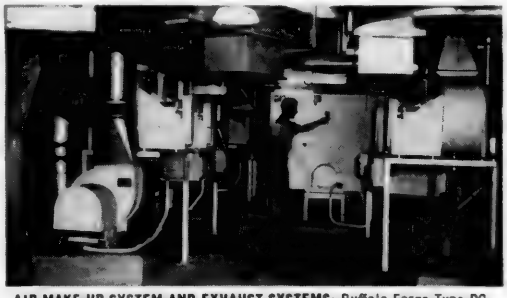
TYPE BL FANS: Buffalo Forge Class #1 unit (L) exhausting several rest rooms at 4725 CFM... another Class #1 exhausting office areas and non-chemical labs at 9700 CFM.

In the world of medicine, purity of ambient air is vitally important to purity of product...and the health of research workers.

That means that impure and contaminated atmospheres must be exhausted and replaced by clean, tempered air . . . continually, dependably, and at installation and maintenance costs that contribute to maximum research capability.

Complete air conditioning systems and supply and exhaust fans by Buffalo Forge fill these requirements not only at Pfizer, but in countless commercial, industrial, and marine applications around the world.

A call to your resident Buffalo Forge representative . . . or the address below... will place sound engineering recommendations at your disposal. Plus the widest range of air and liquid handling equipment in the industry.



AIR MAKE-UP SYSTEM AND EXHAUST SYSTEMS: Buffalo Forge Type PC unit (center rear) distributing 50° tempered air to six labs at 10,800 CFM... seven Belted Vent Sets exhausting from laboratory hoods at 2900, and 1500 CFM.

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Buffalo, New York

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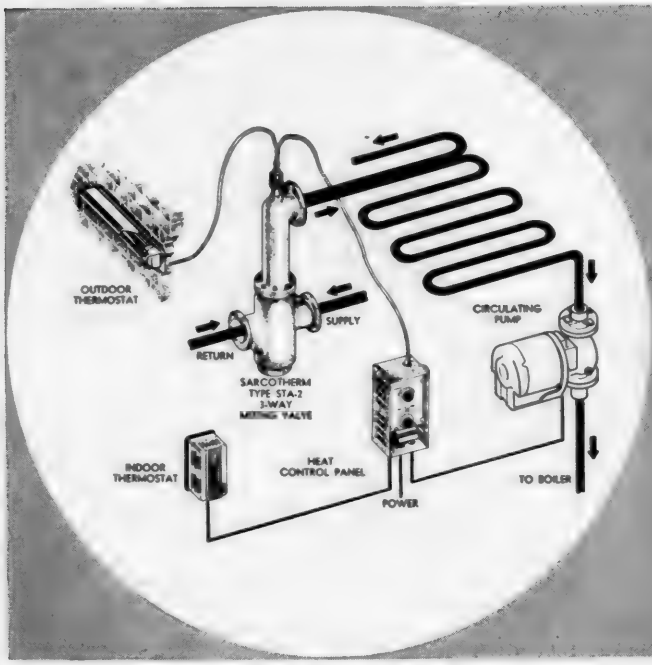

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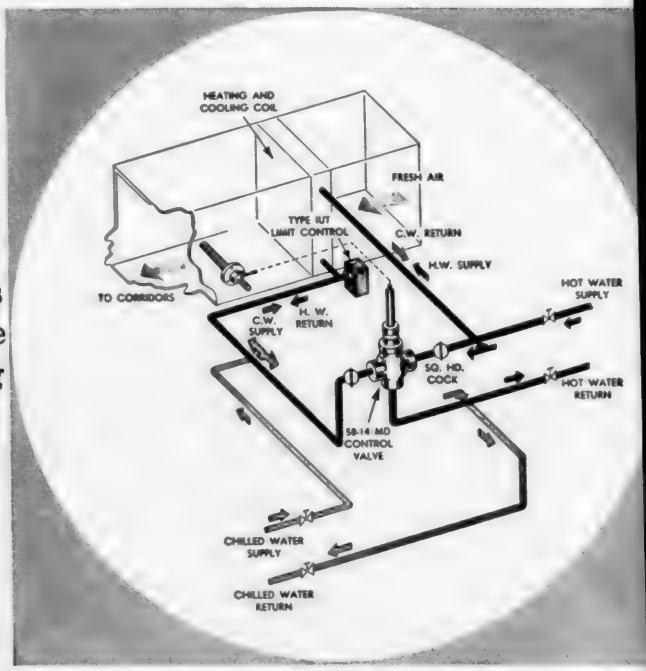

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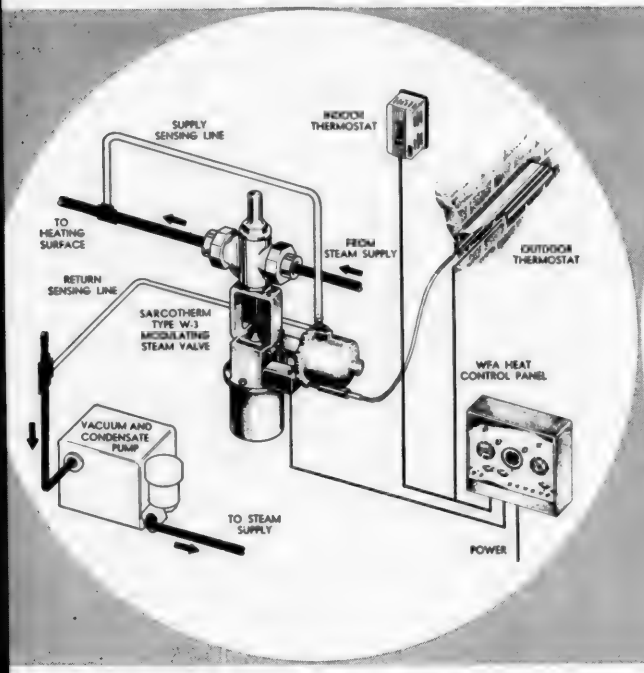

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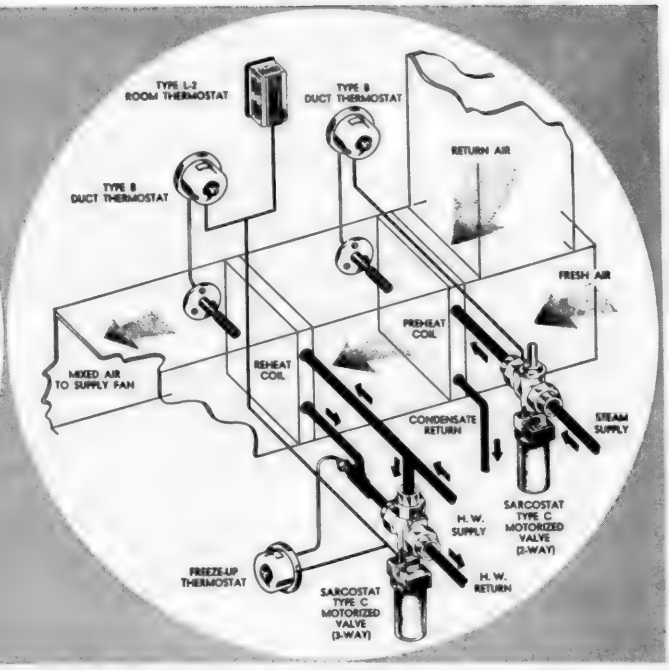

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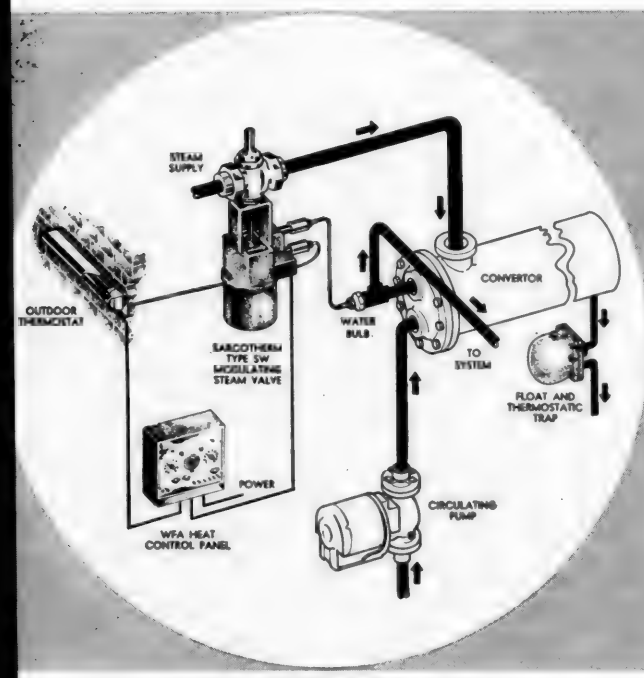

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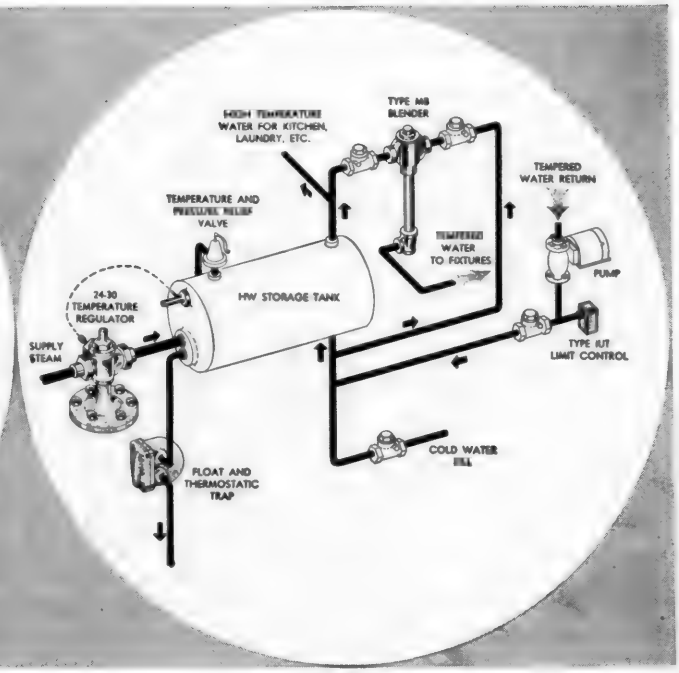

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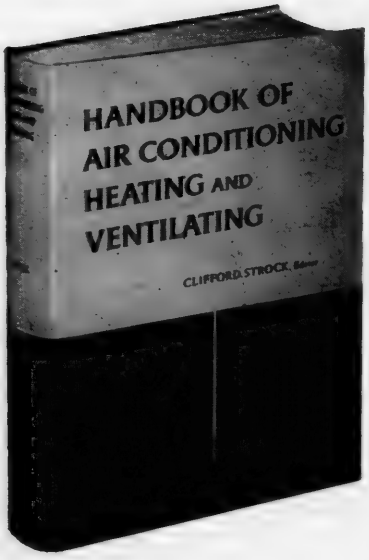

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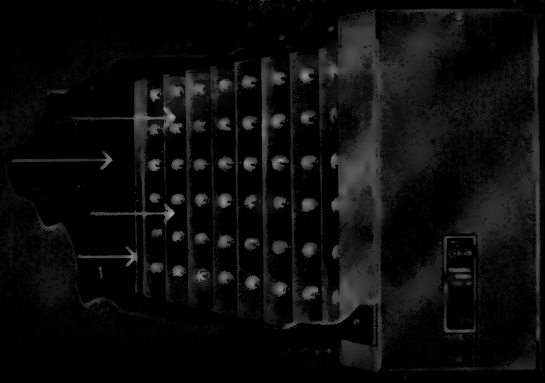

INDEECO Electric Blast Coil Heater in duct installation

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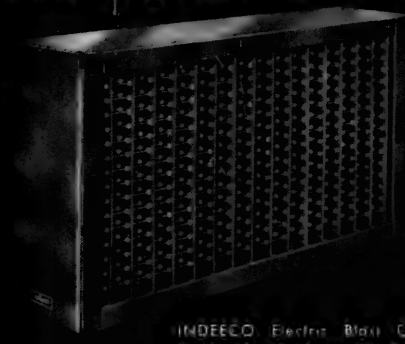

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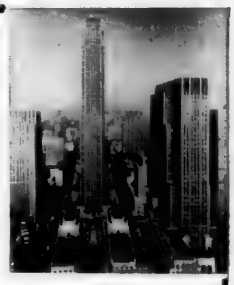

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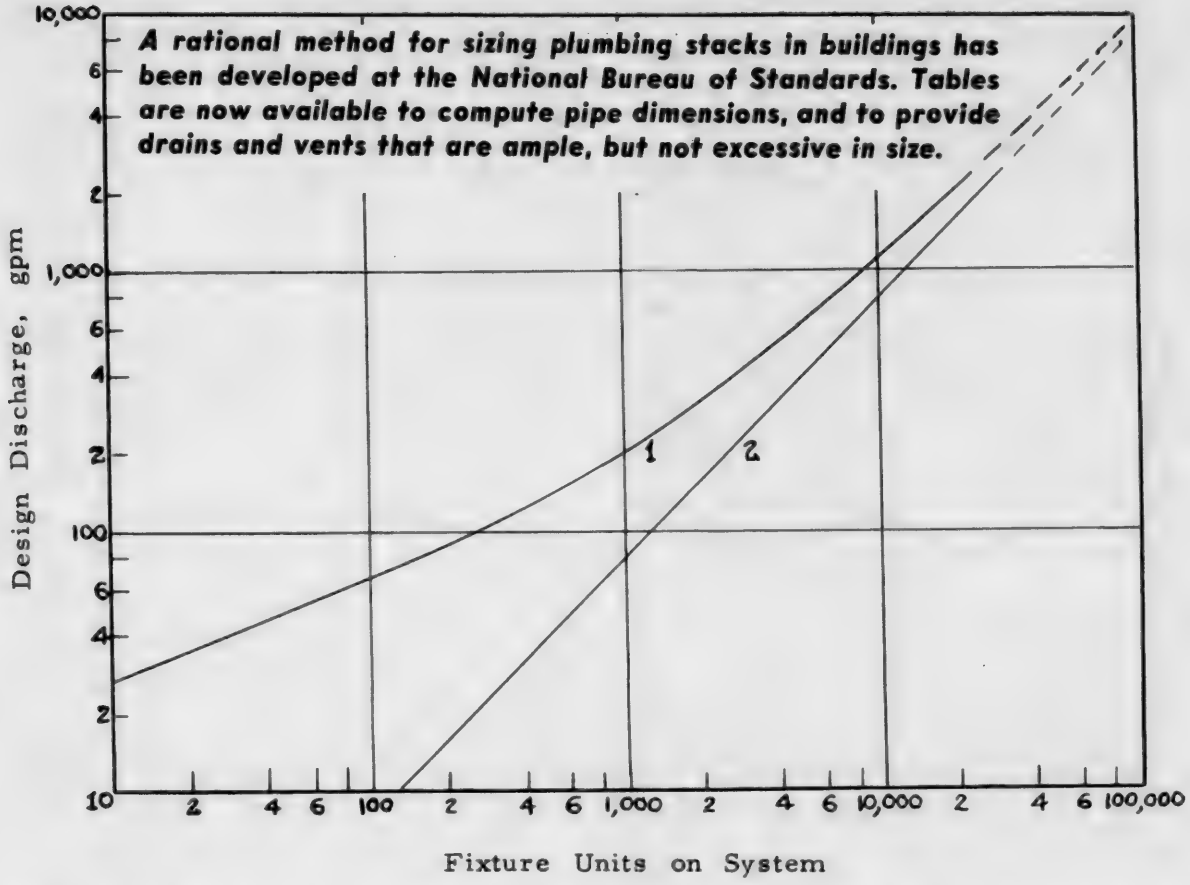

Fig. 1. Design-flow curves for plumbing-drainage systems. Curve 1 represents the **peak** discharge into the drainage system which will not be exceeded more than 1% of the time during periods of heaviest use. Curve 2, shown for purposes of comparison only, shows the **average** discharge into the drainage system during periods of heaviest use computed from the discharge characteristics of water closets.

New data for sizing PLUMBING STACKS in buildings

THE TASK OF THE PLUMBING ENGINEER is to specify the smallest possible and least expensive pipes that are adequate to carry maximum expected loads. To help him do this, a study at the National Bureau of Standards on mechanics of flow in main vertical plumbing drains and vents in buildings has provided information useful in development of rational requirements for sizing stacks.

Computation of minimum adequate sizes of pipes is particularly important in systems for tall buildings and for buildings covering large areas. Many such systems are large and complex enough to afford opportunities for appreciable savings through design methods based on research.

The NBS study has resulted in a number of equations, tables, and charts to compute pipe dimensions, providing drains and vents that are ample, but not excessive, in size. Conducted by Robert S. Wyly and Herbert N. Eaton, the study is presented in detail in Bureau Monograph No. 31.[1]

Design Flow

Two basic factors determine pipe size requirements: (1) the *flow capacity* of the pipe under service conditions; and (2) the *design flow* expected under service conditions.

Design flow is the peak volume rate of flow estimated to occur sufficiently often to warrant consideration in the design of the system. For systems serving more than a very limited number of fixtures, this requires a systematic method of computing the simultaneous discharge rate from a given group of fixtures which, over a long period of time, will not be exceeded except for a specified small fraction of time during periods of heavy use.

Significance of the term *design flow* can be appreciated by considering the problem of determining the sizes of pipes required for a large apartment building. Computations show that unreasonably large pipes would be needed to carry the flow rate if all the plumbing fixtures were discharged simultaneously. The design flow is a more reasonable rate of flow discharged by simultaneous operation of some, but not all, of the fixtures.

The Fixture Unit

Design flow is computed by a method based on the theory of probability.[2,3] First of all, total *fixture units* to be installed in the building or on the pipe under consideration is calculated. Each type of fixture has a fixture unit value or weight which depends on (1) the rate of discharge from the fixture, (2) the duration of a typical operation, and (3) the average time between successive operations during heavy usage. Thus, by the fixture unit method or rating, each fixture is rated on its probable load-producing effect.

Curve 1, Fig. 1, has been developed by the Bureau to make possible an estimate of peak discharge for design purposes (design flow) in gallons per minute in building drainage systems having fixture units totaling between 10 and 100,000. (Curve 2, Fig. 1, represents the average discharge from a system of water closets, each of which discharges 4 gal of water once in 5 min, and is shown for purposes of comparison only.)

The concepts on which the curves in Fig. 1 are based were developed in earlier studies at the National Bureau of Standards and elsewhere; and a curve similar to Curve 1, covering fixture unit totals between 10 and 3,000 was developed in an earlier NBS study.[2] In the current study, for fixture unit loads up to 4800, Curve 1 has been computed from tables of the cumulative binomial probability distribution. The portion of the curve beyond 4800 fixture units has been computed from Poisson's approximation to the binomial distribution.

Loadings for Soil and Waste Stacks

The current investigation also resulted in calculation of permissible loadings for soil and waste stacks of various heights (Table 1). It should be noted that, in the case of soil or waste stacks having only one or a few branch intervals, it is possible that the limit on total fixture-unit load for the stack actually may be governed by limitations on horizontal branch loads rather than by the limiting values obtained from Table 1. For convenience, load limits for horizontal branches are included with the data for the single-interval stacks.

Sizing Vent Stacks

Permissible lengths of vent stacks (main vents) for various loads on soil and waste stacks up through 16 inches dia were calculated. See Table 2. Here are some of the considerations that went into preparation of the table:

When water is discharged into a soil or waste stack from a horizontal drain, it accelerates rapidly, under the influence of gravity, tending to attain an annular cross-section and to reach practically its terminal velocity in one or two stories height of fall. An equation[1,4] was developed, from analysis of experimental data, for computing this terminal velocity. Another calculation showed the height of fall (terminal length) at which 99% of computed terminal velocity would occur.

When water falls in a soil or waste stack, it carries air along with it, enclosed for the most part within a central core. This leads to substantial fluctuations of pneumatic pressure within the system. If suitable provisions are not made to relieve these pneumatic disturbances, the water seals in the fixture traps will not provide satisfactory protection against the passage into the building of objectionable and possibly dangerous sewer gases.

Another objection to a poorly-vented system is that drainage in such a system may be particularly noisy. In order to design the venting system properly, it is necessary to estimate the rate of air flow which must be carried for any given rate of water flow. Equations were developed to make this estimate for the vertical mains of the venting system.[1,5] The equations were checked by comparison with experimental measurements.

Back-Pressure

Also considered was the fact that, when water is being carried in a drainage stack, being fed simultaneously from above and from a connecting horizontal branch, hydrodynamic back-pressure is generated within the horizontal branch. This may affect the capacities of horizontal branches. Experimental data were utilized in developing equations for predicting capacity of the system under this condition.

Finally, when one or more horizontal branches discharge large quantities of water into a soil or waste stack at a given elevation, without any discharge from higher elevations, energy adjustments at the junction may cause the stack to fill.[6] Experiments have provided data from which a reasonable upper limit on rate of discharge can be set to avoid the generation of too-great pressures at the junction.

TABLE I—MAXIMUM LOADS FOR SOIL AND WASTE STACKS

Stack Diameter, Inches	Number of Branch Intervals									Load Limit for Tall Stack
	1		2	3		4		5		
	Horiz. Branch	B	B	A	B	A	B	A	B	
	Maximum Load, Fixture Units									
1¼	—	—	2	—	—	—	—	—	—	—
1½	—	—	4	—	—	—	—	—	—	—
2	6	8	8	3	9	—	—	—	—	10
2½	12	20	20	8	24	7	28	—	—	28
3 (Soil)	20[a]	30[a]	30[a]	12[b]	36[c]	11[b]	44[b]	10[b]	50[c]	102[c]
3 (Waste)	32	48	48	20	60	18	72	17	85	102
4	160	240	240	100	300	90	360	84	420	530
5	360	540	540	225	675	205	820	190	950	1,400
6	620	930	930	385	1,155	350	1,400	325	1,625	2,900
8	1,400	2,100	2,100	875	2,625	785	3,140	735	3,675	7,600
10	2,500	3,750	3,750	1,560	4,680	1,405	5,620	1,310	6,550	15,000
12	3,900	5,850	5,850	2,435	7,305	2,195	8,780	2,045	10,225	26,000
15	7,000	10,500	10,500	4,375	13,125	3,935	15,740	3,675	18,375	50,000

Stack Diameter, Inches	Number of Branch Intervals									
	6		8		10		12		15	
	A	B	A	B	A	B	A	B	A	B
	Maximum Load, Fixture Units									
3 (Soil)	10[b]	60[c]	—	—	—	—	—	—	—	—
3 (Waste)	16	96	—	—	—	—	—	—	—	—
4	80	480	—	—	—	—	—	—	—	—
5	190	1,080	170	1,360	—	—	—	—	—	—
6	310	1,860	290	2,320	280	2,800	—	—	—	—
8	700	4,200	655	5,240	630	6,300	612	7,350	—	—
10	1,250	7,500	1,170	9,360	1,125	11,250	1,095	13,100	—	—
12	1,950	11,700	1,825	14,600	1,755	17,550	1,705	20,500	1,655	24,800
15	3,500	21,000	3,280	26,240	3,150	31,500	3,060	36,700	2,975	44,600

Note.—Columns headed A—Maximum load within any one branch interval; columns headed B—Maximum load on stack.

[a] These limits are applicable only when the maximum load within any one branch interval is not greater than $N\left(\frac{1}{2n}+\frac{1}{4}\right)$, where N is permissible load on a stack of one or two branch intervals; and n is number of branch intervals on the stack under consideration.

[b] Not more than two water closets.

[c] Not more than six water closets.

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1. Capacities of Stacks in Sanitary Drainage Systems for Buildings, by Robert S. Wyly and Herbert N. Eaton, National Bureau of Standards Monograph 31 (1961), available from the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C., (35 cents).

2. See Methods of Estimating Loads in Plumbing Systems, by Roy B. Hunter, NBS Building Materials and Structures Report BMS65 (1940).

3. Fixture unit ratings as used in plumbing system design, Housing Research Paper 15, Housing and Home Finance Agency (1951).

4. See also, Report on Hydraulics and Pneumatics of Plumbing Draining Systems—I, by F. M. Dawson and A. A. Kalinske, University of Iowa Studies in Engineering, Bulletin 10 (1937).

5. See also, Report on the Hydraulics and Pneumatics of the Plumbing Drainage System, by F. M. Dawson and A. A. Kalinske, Technical Bulletin 2 of the National Association of Master Plumbers of the United States, Inc. (1939).

6. See Recommended Minimum Requirements for Plumbing in Dwellings and Similar Buildings, (1924), NBS Building and Housing Publication *BH2;* also Recommended Minimum Requirements for Plumbing, (1932), NBS Building and Housing Publication *BH13*, available from the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C., (price $1.50).

TABLE 2 →

TABLE 2—SIZE AND LENGTH OF VENT STACKS

Drainage* Stack Diameter, Inches	Water Discharge Rate, Gpm	Load on Drainage Stack, Fix. Units	Vent Stack Diameter, Inches**							
			1½	2	2½	3	3½	4	5	6
			Maximum Developed Length of Vent, Feet							
3	22.0		42	145	355	1040	—	—	—	—
	35.6	21	32	110	270	805	—	—	—	—
	51.6	53	27	94	230	680	—	—	—	—
	66.8	100	25	86	210	620	—	—	—	—
	70.0	110	24	85	205	610	—	—	—	—
	83.4	160	23	81	200	585	—	—	—	—
4	47.5	43	—	35	85	250	520	975	—	—
	76.7	140	—	27	65	195	400	750	—	—
	111	320	—	23	55	165	335	635	—	—
	144	530	—	21	50	150	310	580	—	—
	151	580	—	20	49	147	305	570	—	—
	180	850	—	19	47	140	290	545	—	—
5	86.1	190	—	—	28	82	170	320	985	—
	139	490	—	—	21	63	130	245	760	—
	202	940	—	—	18	53	110	207	640	—
	261	1,400	—	—	16	49	101	189	585	—
	273	1,500	—	—	16	48	99	186	575	—
	326	2,000	—	—	15	46	95	179	555	—
6	140	500	—	—	—	33	69	130	400	1,000
	226	1,100	—	—	—	26	53	100	310	775
	328	2,000	—	—	—	22	45	84	260	655
	424	2,900	—	—	—	20	41	77	240	595
	444	3,100	—	—	—	19	40	76	235	590
	529	3,800	—	—	—	19	39	73	225	565

Drainage* Stack Diameter, Inches	Water Discharge Rate, Gpm	Load on Drainage Stack, Fix. Units	Vent Stack Diameter, Inches**							
			4	5	6	8	10	12	14	16
			Maximum Developed Length of Vent, Feet							
8	301	1,800	31	95	240	940	—	—	—	—
	487	3,400	24	73	185	720	—	—	—	—
	706	5,600	20	62	155	610	—	—	—	—
	913	7,600	18	56	140	555	—	—	—	—
	957	7,900	18	56	140	550	—	—	—	—
	1140	9,800	17	53	135	525	—	—	—	—
10	546	4,000	—	31	78	305	960	—	—	—
	883	7,200	—	24	60	235	735	—	—	—
	1280	11,000	—	20	51	200	625	—	—	—
	1660	15,000	—	18	46	180	570	—	—	—
	1730	16,000	—	18	46	180	560	—	—	—
	2070	19,000	—	17	44	170	535	—	—	—
12	889	7,300	—	—	31	120	380	940	—	—
	1440	13,000	—	—	24	94	295	720	—	—
	2080	20,000	—	—	20	79	250	610	—	—
	2690	26,000	—	—	18	72	225	555	—	—
	2820	27,000	—	—	18	71	225	550	—	—
	3360	34,000	—	—	17	68	215	525	—	—
15	1610	15,000	—	—	—	40	125	305	480	940
	2600	25,000	—	—	—	31	96	235	370	720
	3770	38,000	—	—	—	26	81	200	310	610
	4880	50,000	—	—	—	24	74	180	290	555
	5110	53,000	—	—	—	23	73	180	280	550
	6100	64,000	—	—	—	22	70	170	270	525

* Drainage-stack diameters used in computations are nominal.

** Vent-pipe diameters used in computations are the actual diameters given in current standards for standard steel pipe 12 inches or less in diameter, and for Schedule 40 steel pipe of 14- and 16-inch diam. It is to be understood, in the use of this table, that the developed length of vent may include some piping in an other-than-vertical position.

New chart for solar collectors pinpoints

Optimum Angle of Inclination

NESE DERIS

Design Engineer, New York, N. Y.

THE OPTIMUM ANGLE of inclination of a fixed flat solar collector can be found for any locality. The method is applied here only to 40° latitude, but similar calculations can be made for any other.

Angle Between Sun's Rays and a Wall

Figure 1 enables us to find the angle between solar rays and a vertical surface. With the sun assumed to be at A, the solar incidence angle is α. Total intensity of solar rays received at the earth's surface is represented by AC, the vector of solar rays incident upon the vertical surface, by BC. Then, it follows that:

$$AC = \frac{CE}{\cos \text{ altitude}} \quad (1)$$

$$BC = CE \cos \beta \quad (2)$$

$$\sin \alpha = BC/AC \quad (3)$$

Substituting (1) and (2) in (3),

$$\sin \alpha = \frac{CE \cos \beta}{CE/\cos \text{ altitude}} = \cos \text{ altitude} \cos \beta \quad (4)$$

reflection, the theoretical transmission through the glass will be equal to BC. Since BC is AC sin α, if

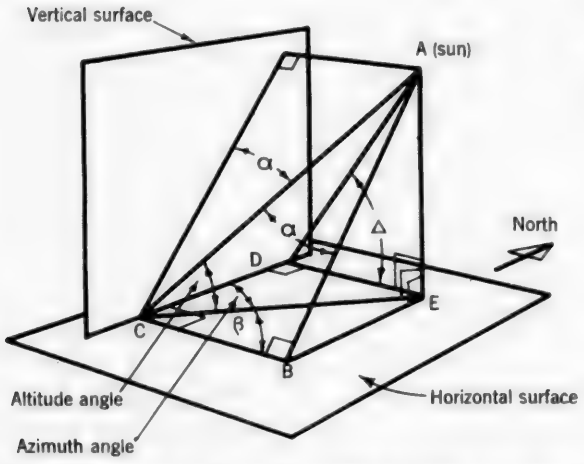

Fig. 1. Diagram for finding the angle between solar rays and a vertical surface.

Angle β can be calculated from the azimuth angle. Since complete information[1] is available for both altitude and azimuth angles, it is possible to find angle α from (4) for any hour of any month and for any exposure. In Fig. 1, the vertical surface is shown as facing east to make it easy to understand Example 1 below. However, equation (4) holds true for any exposure. Example 1 illustrates the use of equation (4).

Example 1:

Given: Vertical surface facing east at 6 a.m. in June.

Required: Angle α

Solution: altitude angle[1] = 15°, cos altitude = 0.966
azimuth angle[1] = 72°
β = 90 − azimuth angle = 18°,
cos β = 0.951
sin α = cos altitude cos β = 0.917
α = 66.5°

Transmission Through Glass

How does solar transmission through a vertical piece of glass vary as α changes? Assuming that the vertical surface in Fig. 1 is glass and that there is no total intensity of solar rays, AC, is assumed to be unity, then transmission through the glass, BC, will equal sin α. When solar transmission (or sin α) is plotted against α, the result is a sine wave, one quarter of which is shown in Fig. 2.

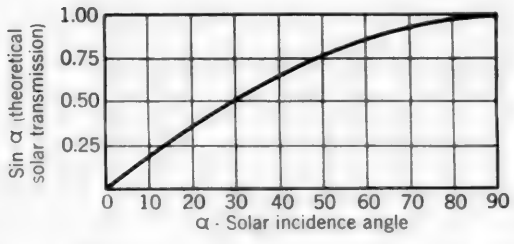

Fig. 2. Theoretical solar transmission varies as the sine of the solar incidence angle.

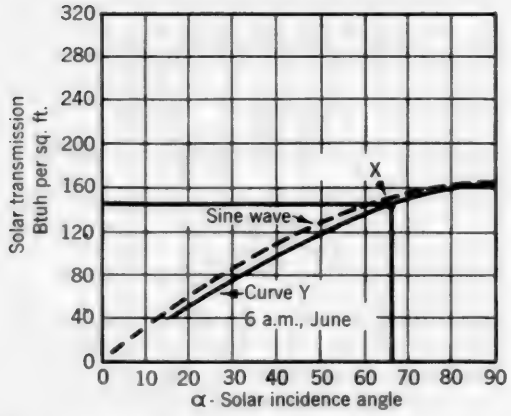

Fig. 3. Actual solar transmission varies almost as the sine of the solar incidence angle.

The relationships shown in Fig. 2 represent the ideal case where reflection is disregarded. Actually, the curve is not a true sine wave. According to available data[1] on solar transmission, at 6 a.m. June, transmission through one square foot of steel sash window, on an east exposure, is 148 Btuh. In Fig. 3, actual transmission through glass is shown as a function of the solar incidence angle α. Making use of Example 1, one can plot point X which indicates that, at 6 a.m. in June, when α is 66.5°, the transmission will be 148 Btuh per sq ft.

Similar investigations of other exposures, for 6 a.m. in June, yield enough points to enable us to draw curve Y, Fig. 3, which gives the intensity of solar transmission to be expected for any value of α, regardless of the orientation of the glass surface, at 6 a.m. in June.

When the true sine wave in Fig. 2 is superimposed on curve Y in Fig. 3, the apexes of both curves being made to coincide, it can be seen that curve Y is much like a sine wave, except that its lower portion shows a depression because, at low values of α, reflection from the glass surface is greater, hence, the amount transmitted is less.

A family of curves similar to curve Y for all hours of the day in June is shown in Fig. 4. Because altitude and azimuth angles are the same, the curve for 9 a.m. is identical with the curve for 3 p.m., and 8 a.m. with 4 p.m., etc. Because the sun is due south at 12 noon, and because a symmetry exists on either side of 12 noon, fixed solar collectors are always faced directly south.

Transmission Through an Inclined Surface

From Fig. 4 we can find the value of solar transmission through glass at any hour in June, provided α is known. What effect does the collector inclination angle have? In Fig. 5 the sun is again assumed to be at A, total intensity of solar rays received at the earth's surface is represented by AC, and the vector of the solar rays incident upon the solar collector is represented by AF. Collector inclination angle is ϕ, and α is the solar incidence angle. Then it follows, that:

$$AF = AD \sin \theta \qquad (5)$$

$$AD = AE / \sin \Delta \qquad (6)$$

Substituting (6) in (5),

$$AF = AE \sin \theta / \sin \Delta \qquad (7)$$

Also,

$$AC = AE / \sin \text{altitude} \qquad (8)$$

$$\sin \alpha = AF / AC \qquad (9)$$

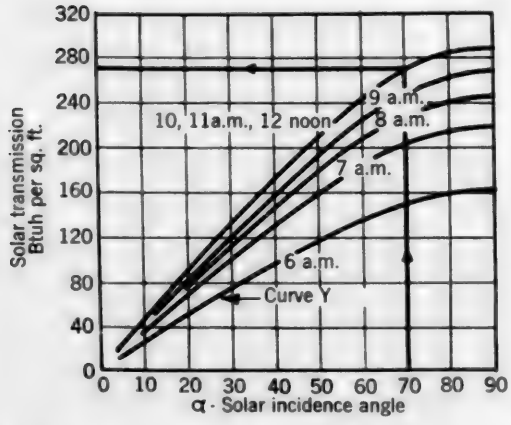

Fig. 4. Add the element of time to Fig. 3 and the result is a family of curves. Data for 40 deg N Latitude in June.

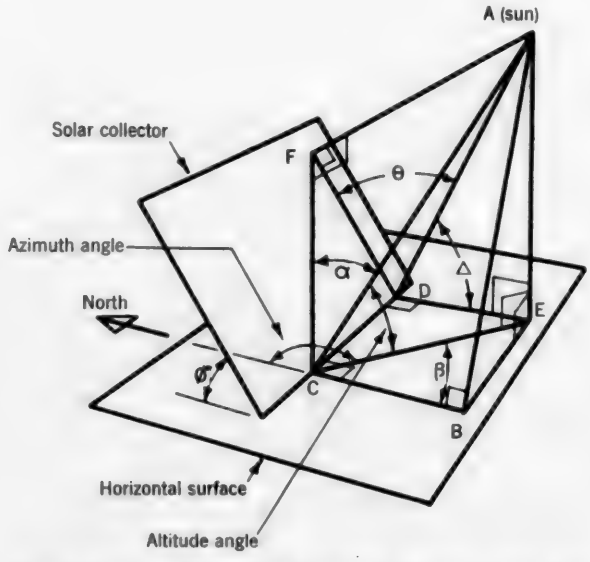

Fig. 5. Diagram for finding the angle between solar rays and an inclined surface.

Substituting (7) and (8) in (9),

$$\sin \alpha = \frac{AE \sin \theta / \sin \Delta}{AE / \sin \text{altitude}} = \frac{\sin \theta \sin \text{altitude}}{\sin \Delta} \quad (10)$$

The right side of equation (10) consists of values that can be either acquired directly or calculated from available data.

It can be shown that[1]

$$\tan \Delta = \tan \text{altitude} / \cos \beta \quad (11)$$

Angle β is dependent on the azimuth angle. The altiture angle is available from published data[1]. Angle θ is determined after angle Δ is calculated. These calculations eventually yield the value of angle α. The following example will help to clarify the point:

Example 2:

Given: At 11 a.m. in June a solar collector is facing south and the collector inclination angle is 40°.

Required: Angle α.

Solution: azimuth angle[1] = 138°,
angle β = 180 − azimuth angle = 42°
altitude angle[1] = 69°
$\tan \Delta = \tan \text{altitude} / \cos \beta = \tan 69° / \cos 42° = 2.6 / 0.743 = 3.5$
angle Δ = 74°
angle θ = 180 − angle ϕ − angle Δ = 180 − 74 − 40 = 66°
$\sin \alpha = \sin \theta \times \sin \text{altitude} / \sin \Delta$ (equation 10)
$\sin \alpha = 0.914 \times 0.934 / 0.961 = 0.888$
α = 62.6°

Therefore, if collector inclination angle ϕ is 40°, then, at 11 a.m. in June, α will be 62.6°. This information is plotted in Fig. 6 as Point *Z*. Repeating for other values of ϕ, yields the 11 a.m. curve in Fig. 6. Similarly, curves can be obtained for other hours, as shown in Fig. 6. Now we can know α for any hour of a day in June and for any value of ϕ.

Optimum Angle

By using Fig. 4 and 6 simultaneously, the behavior of a flat solar collector can be analyzed, as illustrated in Eample 3.

Example 3:

Given: At 11 a.m. in June, a solar collector is facing south and the collector inclination angle ϕ is 30°

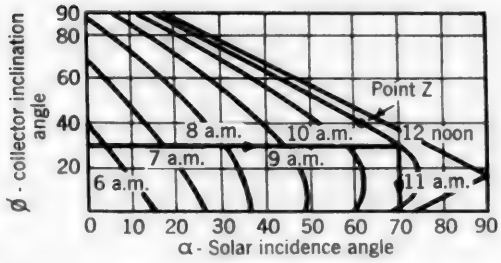

Fig. 6. Showing relationship between the collector angle and solar incidence angle. Data for 40 degrees North Latitude in June.

Required: Solar transmission per square foot of collector surface

Solution: Enter the ordinate of Fig 6 at 30°. Go horizontally to the 11 a.m. curve, then down. Angle α = 70°. Enter Fig. 4 at α = 70° go up to the 11 a.m. curve, then to the left. Solar transmission is 273 Btuh per sq ft.

Fig. 4 and 6 are combined in Fig. 7. The solution to Example 3 is traced by arrows. Other families of curves, similar to Fig. 7, can be drawn to cover all the months of the year. With their help, we can analyze collector behaviour for various values of angle ϕ. For instance, when the collector inclination angle ϕ is set at 40° in June, the following transmission values are obtained:

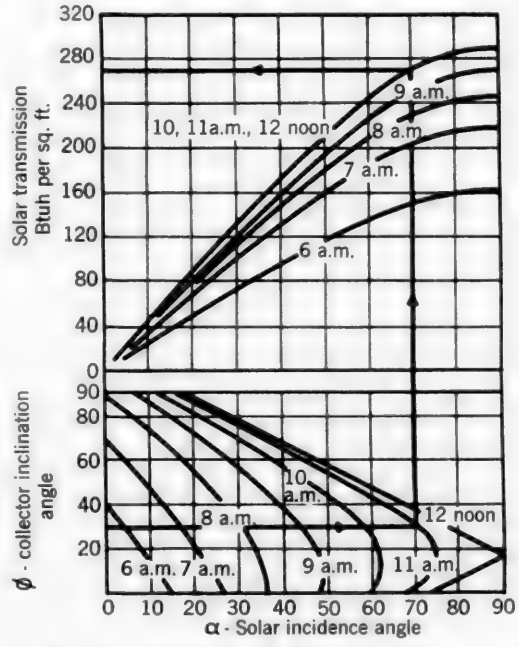

Fig 7. Figures 4 and 6 are combined in one chart, providing direct solution for Example 3.

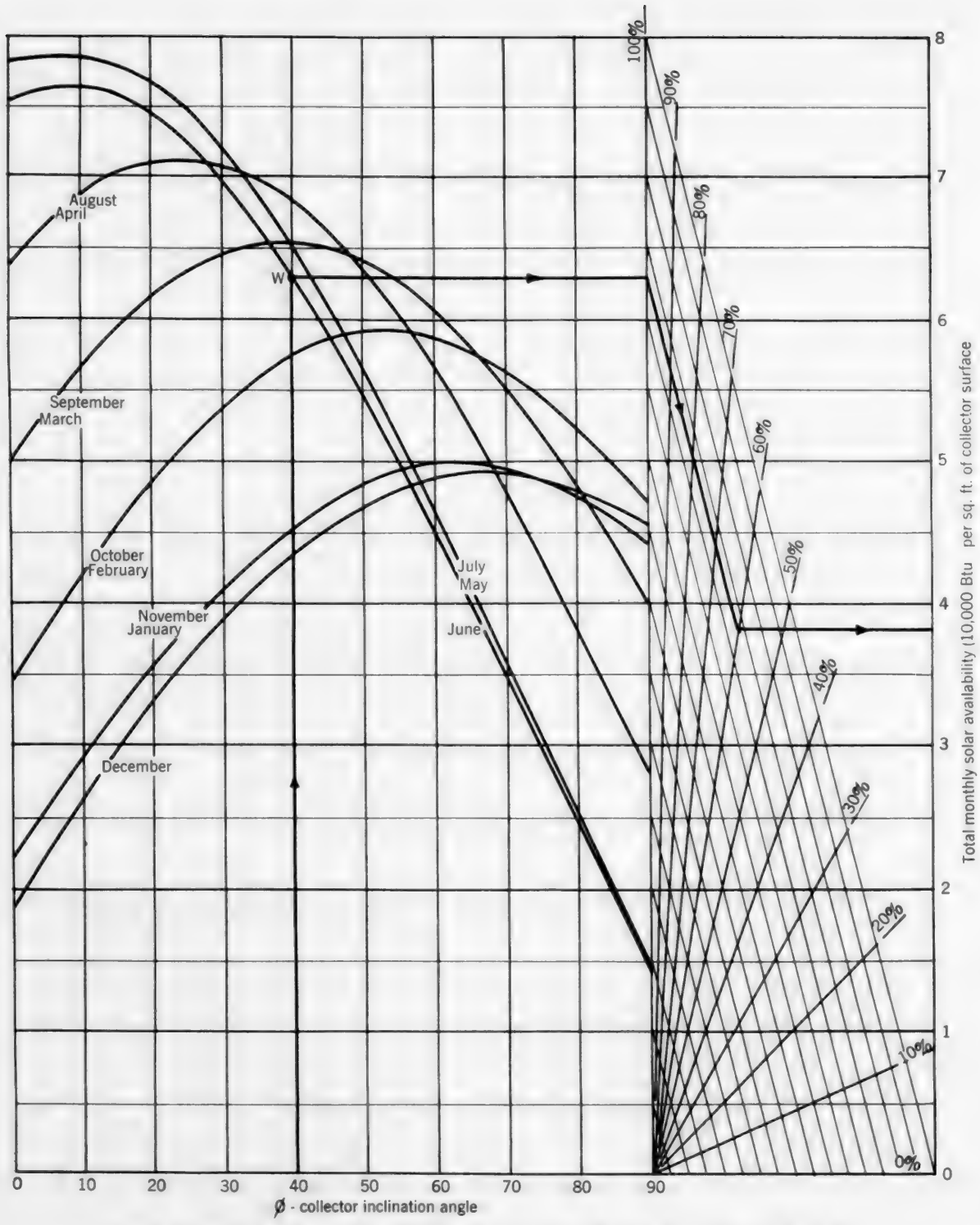

Fig. 8. Chart for finding optimum angle for solar collectors for each month of the year. Data applies to 40 degrees North Latitude, but is approximately correct for most of the United States.

12 noon = 266 Btu per sq ft
11 a.m. = 253
10 a.m. = 226
9 a.m. = 162
8 a.m. = 104
7 a.m. = 47
6 a.m. = 0

Total 1,058 Btu per sq ft

(Please turn to page 101)

VAPOR BARRIERS

for walls of air-conditioned buildings

HARRY T. MEI

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The problem of moisture condensation in walls is much different in cooled than in heated buildings, and where both are combined in one—the year-round conditioned house—the solution is not always simple. The author presents some data in the form of a progress report based on tests at The University of Texas.

FOR MANY YEARS recommended practice has been to place the vapor barrier on the heated side of the insulation. The reason is sound. The rooms, especially when the doors and windows are closed, accumulated a high humidity during occupancy due to excess moisture from washing, cooking, and partying. As this warm humid air pushes toward the cold side of the wall with its lower vapor pressure, the migrating air is chilled below the dew point. Condensation results, and the insulation is saturated with moisture. For a cold room the process would be just reversed, especially in summer when the hot outside air, often with a relatively high absolute humidity, moved inward to the cold room and it would either deposit its condensation within the insulation or move into the storage room and deposit as frost on the refrigeration coils. Thus in each case the recommended vapor barrier was placed next to the warm side of the wall which was on the inside wall surface for winter heating and on the outside wall surface for cold storage rooms.

With the advent of summer cooling of the same rooms that are to be heated in winter, more complex problems faced the designer. If the owner of a building insisted on cooling his rooms below the dew point of the atmospheric air, then he would be faced with the same problem as the cold-storage room designer, and for the summer period his vapor barrier should be at the outer wall. Did this mean that all year-round air-conditioned buildings should be insulated with vapor barriers on both the inner and outer walls? What other alternatives are there to produce a practical building wall in which the insulation will retain high resistance to heat flow?

Tests, consultations and research studies have suggested that properly designed vapor barriers combined with controlled ventilation can reduce condensation in a wall or roof to a safe level.

A small insulated chamber (6 x 5 x 5 feet; see Fig. 1) was planned and constructed for moisture tests in July, 1959, in the Mechanical Engineering Laboratory of The University of Texas, and a series of experiments were started in order to investigate the moisture problems that occur under different climatic conditions.

A partition was installed at the center of the chamber to divide it into hot and cold sides. The partition consisted of two test windows and a small vision window at the center. Because of the limited space, the compressor unit had to be located on the roof of the chamber.

A temperature controller was located on the side wall of the cold room about 4 ft above the floor to control the operation of the compressor. The temperature control range was established from 0 to 95 deg F.

Steam was used as the moisture source, automatically admitted by means of a humidity controller (20 to 96% hr) and a solenoid valve. The temperature of the hot room was maintained by an electrical heater which was controlled by a thermostat (60 to 105 deg F), located on the side wall of the room, side by side with the humidity controller, about 4 feet above the floor.

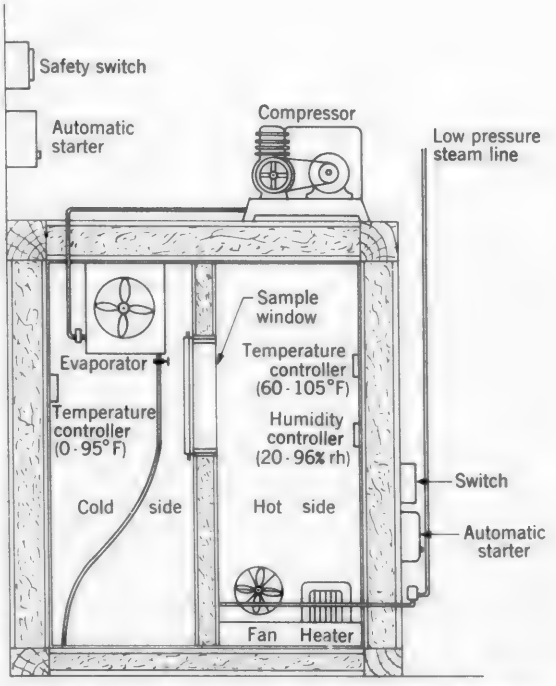

Fig. 1. Moisture chamber for testing wall samples.

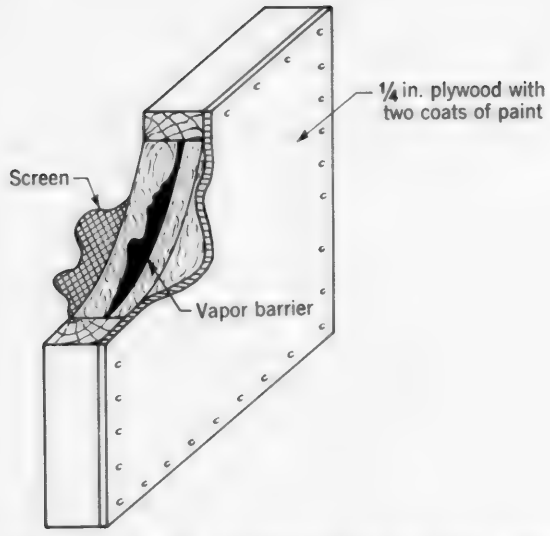

Fig. 2. Sample (No. 3) of insulated wall with vapor barrier inside the insulation.

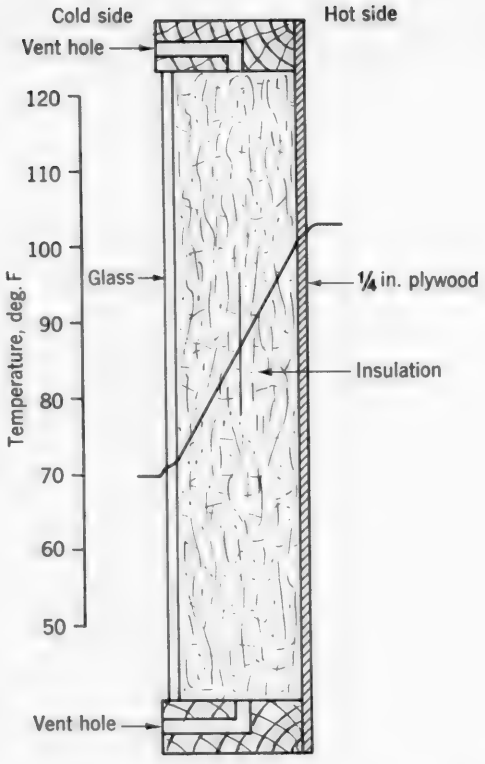

Fig. 3. Temperature distribution through Wall Sample 4.

Placement of Vapor Barrier

Sample No. 3, illustrated in Fig. 2, has a vapor barrier inside the insulation and located about one inch away from the plywood siding. This location was based on the calculation of winter and summer test conditions, so that the temperature of this vapor barrier should be above the dew-point temperature of the warm side under both winter and summer conditions.

During the period from November 9-15, 1959, Sample 3 was tested under winter conditions. The cold side conditions were set at 24 deg and 70% rh, hot side at 87 deg and 50% rh. The vapor barrier temperature was recorded by a thermocouple. The temperature during the test period was always above the dew point temperature of the warm side (66 deg). During and at the end of the test, there was no trace of condensation shown at any location in the sample, and the vapor barrier was dry and in perfect condition.

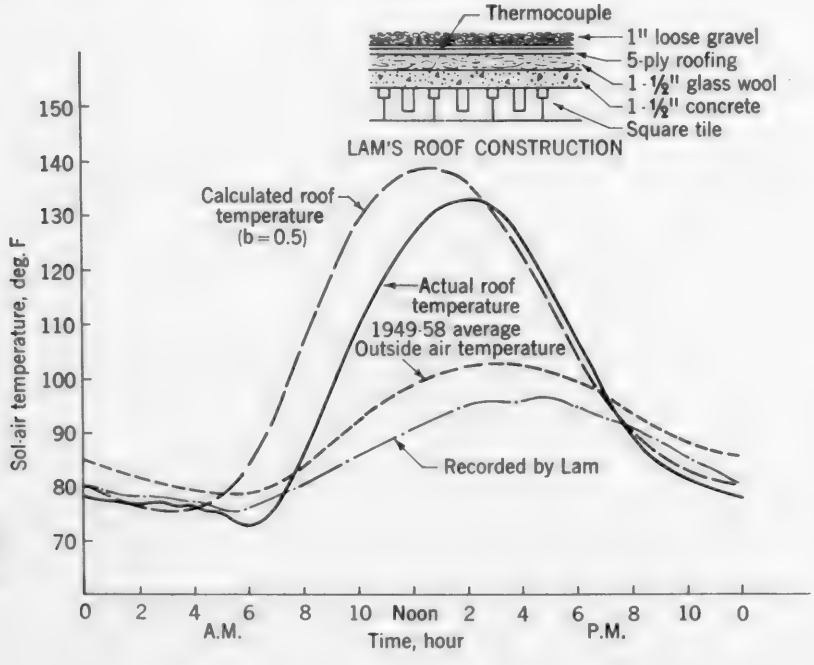

Fig. 4. Comparison of actual vs. calculated roof temperatures and actual vs. average outside air temperatures.

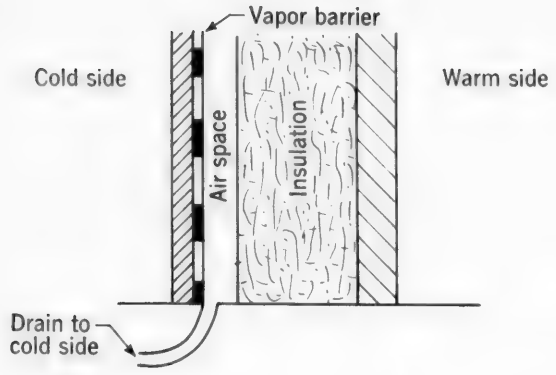

Fig. 5. Use of drains to remove wall condensate.

The sample was put back for test under the summer condition (hot side at 103 deg and 65% rh with cold side at 70 deg and 50% rh) for the next three weeks, from November 18 to December 5, 1959. The recorded barrier temperatures were above the dew point temperature of 90 deg. There was no condensation shown on the vision glass window during the test. At the end of the test, increase or decrease in weight was indicated for the sample; the barrier was in perfect condition, and there was no trace of condensation at any place inside the wall. One method, therefore, of solving the condensation problem is to place the vapor barrier inside the insulation where its temperature will always be above the dew-point of the warm side condition.

Ventilation of Wall

Sample No. 4 (see Fig. 3) was constructed to investigate the ventilation effect on condensation. A perfect vapor barrier (glass) was installed on the cold side of the sample, and a total of six ½-inch diameter vent holes were drilled on the top and bottom of the frame (three on each), facing to the cold room.

This wall was tested under summer conditions with Sample No. 3 during the three weeks' test period. The temperature of the inside surface of the glass was recorded by thermocouple, and it varied from 71 to 73 deg F during the test period. Of course, these temperatures were more than 15 degrees below the dew point temperature (89 deg) of the warm side condition, but there was no condensation shown on the glass during the test period. At the end of the test, the sample was in a very good condition, and no condensation was found inside the sample.

Sol-Air Temperatures

The local weather analysis and a thorough study of the meteorological data of the region are essential to determine limiting conditions. The Sol-Air Temperature method suggested by Mackey and Wright may be used in determining the conditions necessary to avoid wall condensation over the year. Fig. 4 shows the comparison between calculated design data, using b=0.5 in the Mackey and Wright method, and actual data as recorded by Lam. The temperatures were recorded on the roof under one inch of loose gravel by a thermocouple in Austin, Texas, in August, 1951 by Mr. Lam.

TABLE 1—AVERAGE DAILY TEMPERATURES

New York City, Lincoln, Neb.: July
Austin, Tex., New Orleans, La.: July-August

Surface Orientation	b	New York	Lincoln	Austin	New Orleans
		Average Daily Sol-Air Temperatures, Deg F			
Outdoor, in shade	0	84.8	94.4	90.0	85.8
Horizontal	0.4	93.2	105.3	99.4	95.0
	0.7	99.8	113.4	106.2	102.1
	1.0	106.4	121.6	112.9	109.1
Vertical, facing N	0.4	86.2	96.1	90.9	86.6
	0.7	87.3	97.4	91.5	87.3
	1.0	88.5	98.6	92.1	87.9
Vertical, facing E	0.4	87.8	99.0	94.5	90.3
	0.7	89.9	102.5	98.0	93.8
	1.0	92.3	105.9	101.3	97.2
Vertical, facing S	0.4	87.1	97.5	91.8	87.4
	0.7	89.0	99.8	92.8	88.7
	1.0	90.7	102.1	94.1	89.9
Vertical, facing W	0.4	89.5	99.3	94.0	89.7
	0.7	93.0	102.9	96.9	92.7
	1.0	96.5	106.6	103.1	95.6

Table 1 gives the average daily design values for July in New York City and Lincoln, Neb., and for July-August in Austin, Tex., and New Orleans, La.

In conclusion, if it is not practicable to install the vapor barrier as proposed here, consideration should be given to the following possible solutions.

Drainage

Provide a drain system immediately below the vapor barrier; then, in case any condensation occurs, it can be drained out to the cold side immediately as shown in Fig. 5.

Controlled Ports

If barriers are used on both sides of its insulation, a method that has been proposed involves the arrangement of each barrier with controlled ports so that the side which is warm can be made vapor tight while the cold side is allowed to breathe. If a building is located at a place with a long heating or cooling season, then one vapor barried with controlled ports installed on the warm side of the long season would be sufficient.

In practice, conditions are not maintained continuously for any given outside air temperature and relative humidity. For this reason, this investigation should be continued not only to study the individual vapor barriers and their limiting conditions but also to consider all of the problems in practical construction by the use of large scale test houses exposed to natural conditions. Continued improvements are being made by different manufacturers to produce a practical vapor barrier that does not deteriorate with age and humidity variations and yet can be economically applied.

What is the Future of

Large Reciprocating Compressors and Systems?

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The general tonnage range where reciprocating and centrifugal chilling machines presently overlap in their field of application is evaluated by the authors. Some unusually accurate prognosticating concludes the article.

ALTHOUGH ITS BASIC DESIGN CONCEPT IS OLD, the large reciprocating compressor is not about to be squeezed out of the market by the modern centrifugal units. On the contrary, we believe that the new hermetic reciprocating systems will not only maintain their present position but actually capture a portion of the hermetic centrifugal market in air conditioning applications up to about 250 tons.

This opinion is based on a comparative evaluation of the most important product features from the end user's standpoint.

To compare the two systems objectively, we have used as far as possible measurable value yardsticks, such as system weight, enclosed volume, floor space, power consumption, operating limits, etc. This list is by no means exhaustive; however, we believe that a few key product feature comparisons will be sufficient to establish some broad demarcation lines between reciprocating and centrifugal systems.

For the sake of brevity we shall confine this discussion to electric driven 60 cycle systems of the hermetic type, which represent the bulk of the present and future large commercial and industrial air conditioning market (disregarding absorption and other heat-powered systems). At the present time hermetic reciprocating units and chillers are available commercially in single factory assembled packages up to 250 tons.

Centrifugal machines now cover a range from 60 tons up to several thousand tons of refrigeration.

In the 60 to 250 ton capacity range, the field of centrifugal and reciprocating machines overlaps and the two systems are in direct competition. The question, therefore, arises as to which type is best suited for a given application.

Size and Weight Comparisons

The hermetic reciprocating chillers are much more compact than the centrifugal systems presently on the market. The enclosed volume of the present reciprocating type hermetic chiller is only one third that of the most modern single stage high speed centrifugal unit.

Floor space requirements are plotted against nominal capacity in Fig. 1, and again the reciprocating machines are shown to have a definite edge. Incidentally, these curves show the major size reduction achieved in centrifugal systems by the introduction of the high-speed geared-up single stage hermetic compressor.

Since the trend in the centrifugal field is definitely toward the more compact high speed single stage design, we shall confine the rest of this discussion to the single stage design.

First Cost

Total system weight is a definite indication of cost. Without discussing this commercial subject in detail, we can safely state that the lighter reciprocating sys-

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David N. Shaw studied mechanical engineering at the University of Massachusetts and served two years in the United States Air Force. Formerly employed by Worthington Corp. as a design engineer in its air conditioning division, he is presently a project engineer in the research and development department of Dunham-Bush, Inc. He is an affiliate member of ASHRAE.

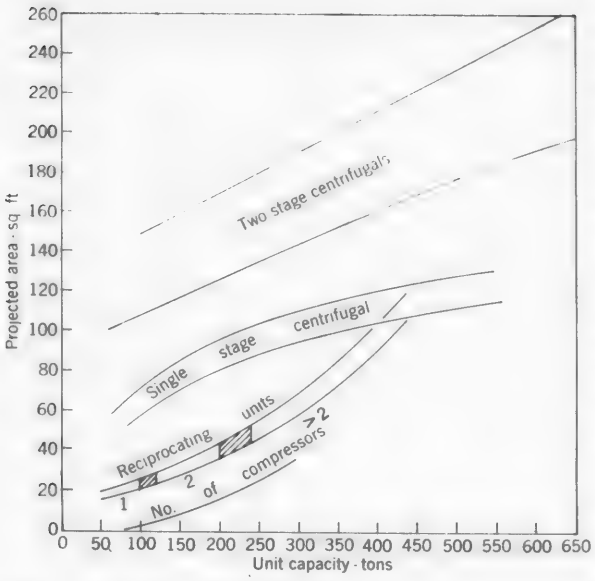


Fig. 1. Hermetic chiller floor space requirements versus nominal capacity.

tems should be competitive certainly up to 250 tons and worth considering in specific applications, even in multiple systems up to 300-400 tons. The application engineer should carefully evaluate the complete system cost, including all auxiliary equipment, to arrive at the most economical selection. This cost study should include all wiring, erection, installation costs and such items as refrigerant charge, insulation, and so forth.

Yearly Energy Consumption

Typical full-load Kw-per-ton curves have been plotted in Fig. 2 together with the proposed ARI maximum Kw-per-ton for centrifugal chillers.

The reciprocating systems are within ARI limits up to 400 tons and competitive with the single stage centrifugal up to 200-250 tons. In the higher tonnage range the centrifugal is superior. The part-load adiabatic efficiency of centrifugal compressors with variable pitch inlet guide vane flow control drops off rapidly as the pre-rotation vanes close with a drop in cooling load; (actually, capacity reduction is achieved to a large extent, and in the fully closed blade position, exclusively, by suction gas throttling, which is inherently an inefficient process). The centrifugal compressor merely appears to be efficient at part load because published part-load Kw inputs are based on a complete chilling system rebalance with full-load water flow through the cooler and condenser. As the chiller load drops, the evaporating temperature increases, the condensing temperature is reduced and the theoretical adiabatic horsepower per ton drops to a fraction of its full-load value.

On the other hand, part-load input curves of reciprocating machines are usually published on the basis of constant evaporating and condensing temperatures which make the reciprocating machine appear less efficient than the centrifugal at part load. However, when applied to a complete chilling system, with temperature controlled unloaders and constant water flow in the cooler and condenser, the reciprocating system compares favorably with the centrifugal chilling machine as indicated in Fig. 3.

It can be concluded from Figs. 2 and 3 that the yearly energy consumption, in Kw-hr, of the latest reciprocating hermetic chillers is competitive with modern single stage centrifugal systems in sizes up to 250 tons.

Taking all the previous factors into consideration we may conclude that the hermetic reciprocating chillers are competitive in sizes up to about 250 tons. The centrifugal chillers will clearly dominate the field in capacities over 250 tons.

Other Factors

The capacity divisions outlined above apply specifically to standard hermetic chilling systems under normal comfort cooling applications; however, many other factors should be considered in making the final selection.

The reciprocating compressors, like all positive displacement machines, can operate over a wide range of evaporating and condensing temperatures without cutting off the refrigerating load. The volumetric efficiency and consequently the volume of gas handled by the compressor will vary somewhat as the system compression ratio changes, but the compressor has no definite quitting point at full or part load, as shown in Figs. 4 and 5.

On the other hand, the hermetic centrifugal compressor, operating at a fixed speed, is essentially a constant head machine with a narrow operating range, limited on one side of the optimum design point by surging and on the other side by "choking". For instance, as the condensing temperature increases beyond its ideal design point, the capacity of the fully loaded compressor drops off rapidly until the machine reaches its pumping limit. At point *S* in Fig. 4, the machine under full load conditions becomes unstable at about 109 deg F maximum allowable condensing temperature. The maximum condensing temperature drops along the "surge line" from *S* to *S'* as the guide vanes are gradually closed to meet the load requirements.

On the other side of compressor design point *D*, the gas flow will increase as the compression head drops until the maximum "choking" flow is reached, as indicated by point *C* in Figs. 4 and 5. A maximum flow is reached when somewhere in the compressor the gas velocity reaches the velocity of sound. Choking is particularly critical in modern compact high speed centrifugal compressors designed to operate at relatively high inlet Mach numbers (.8 to .9 of sound velocity). The compressor adiabatic efficiency drops off rapidly as the choking limit is approached; typical values of over-all efficiency are shown in Figs. 4 and 5.

Centrifugal chiller components must, therefore, be carefully matched and applied so that the system will balance well within the narrow boundaries set by the surge and choke lines.

For instance, because the centrifugal compressor cannot operate beyond the surge line, the condenser and cooling tower selection must be based on maximum anticipated conditions regardless of the frequency of occurrence. Such over-sizing is not necessary with reciprocating machines due to the absence of surging.

With the use of conventional high pressure refrigerants, such as R22, the hermetic reciprocating machine can also be sold as a compressor unit or condensing unit for field application on remote direct expansion coils, with either water cooled, air cooled, or evaporative condensers. In many comfort cooling or heat pump applications, direct expansion air handling coils with remote condensing units result in lower first cost and, due to the absence of a secondary heat transfer medium, lower system operating cost.

These types of applications are open exclusively to the reciprocating machines, since it is highly impractical and uneconomical to pipe in the field various remote components of low pressure, high volume refrigerant centrifugal systems. Centrifugal machines are usually sold exclusively as complete factory engineered chillers.

Mechanical Performance

From the noise and vibration standpoint, the latest available reciprocating hermetic machines are now on a par with the high speed single stage hermetic centrifugal systems. Although the reciprocating compressor has more movable parts than the centrifugal unit, recent improvements in design, material, heat and surface treatment, and the use of highly mechanized and accurate manufacturing techniques have greatly reduced service requirements. It should also be borne in mind that, compared to the old 2-stage centrifugal, the new high speed centrifugals incorporate additional parts, such as a step-up high speed gear train with additional bearings and pinions, all of which are subject to wear and represent a potential source of high pitch noise. The life of these wearing parts is by no means unlimited.

Current centrifugal machines in the low tonnage range (300 tons and below) still use sub-atmospheric refrigerants and require a purge reciprocating compressor unit to dispose of non-condensibles. The use of a purge unit is necessary in order to maintain good performance in view of the extreme sensitivity of centrifugal systems to changes in head pressures.

Conclusions

From the above information we may broadly define the economical field of application for 60 cycle hermetic mechanical refrigeration systems thus:

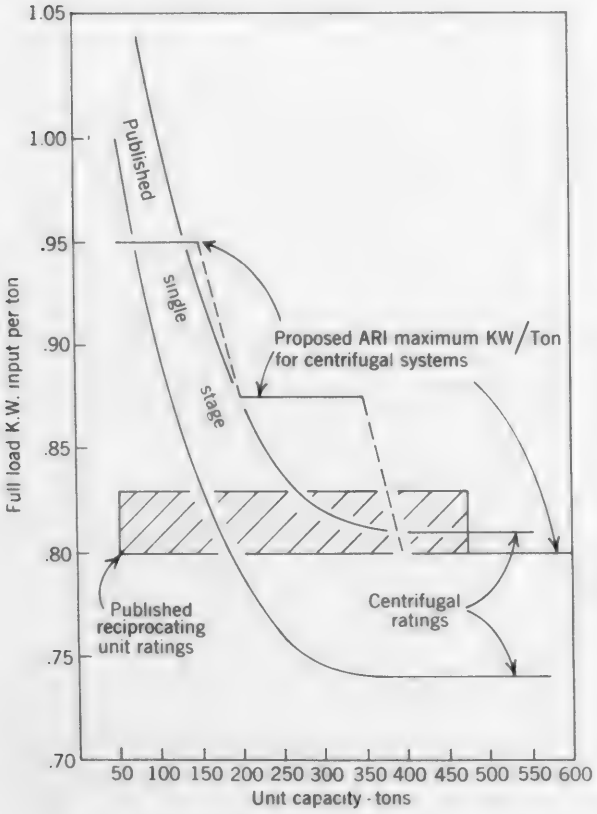


Fig. 2. (Top) Full load efficiency comparisons.

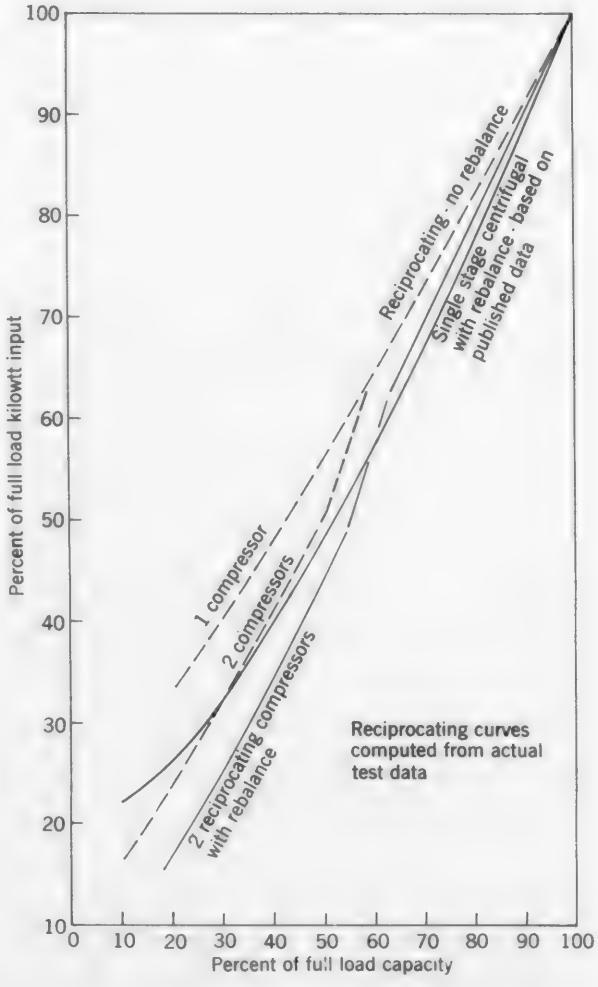


Fig. 3. (Right) Part load efficiency comparisons.

1. The high speed single stage centrifugal liquid chilling systems will be more economical in large air conditioning applications roughly above 250 tons wherever evaporating and condensing temperatures are relatively constant and moderate, as in normal comfort cooling applications.

2. The reciprocating hermetic compressor will best serve the purpose for applications where the compression ratios are high or highly variable, as in commercial, low temperature and heat pump work, and in all applied systems requiring direct expansion air handling units, remote air cooled, or evaporative condensers.

The hermetic reciprocating liquid chilling systems should be competitive with centrifugals up to approximately 250 tons even in normal comfort cooling applications.

Long Range Trend

There is still room for improvement in both the reciprocating and centrifugal compressors. For instance, with water cooled condensers some of the present 1750 rpm reciprocating compressors are rugged enough to withstand higher pressure refrigerants, such as F13B1, to further increase the capacity of present compressor bodies. A major size, weight, and cost reduction would be achieved by developing large two-pole reciprocating compressors. This possibility depends to a large extent on the development of quiet and reliable valves.

Unquestionably, the potential weight, size and cost reduction is much greater for the low tonnage centrifugal units. The introduction of extremely high rotational speed (over 20,000 rpm) could very well wipe out the weight and size advantages of reciprocating systems below 250 tons. These ultra high speed single stage centrifugal compressors would have a two fold advantage:

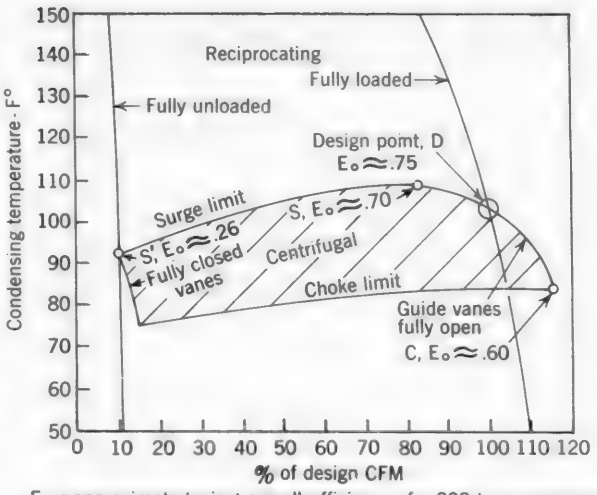
a) Reduce the size of the compressor itself.

b) Allow the use of high pressure refrigerant such as R-12 or R-22 in the smaller sizes with attendant size reduction in the piping, condenser and evaporator, along with the elimination of the present purge unit.

The major technical problem to overcome lies in the development of a reliable, quiet, inexpensive gear, or some other method, to step up the speed from 3500 rpm to the required compressor rpm. It is a possibility that such developments will materialize shortly. However, these ultra high speed compact centrifugals would still suffer (probably even to a larger extent than present designs) from the inherently narrow operation range of turbo compressors, thus leaving many markets open to the flexible reciprocating machines. Eventually the gap between reciprocating and turbo machines may very well be bridged by non-reciprocating high speed positive displacement compressors, combining the advantages of both reciprocating and centrifugal designs; for example:

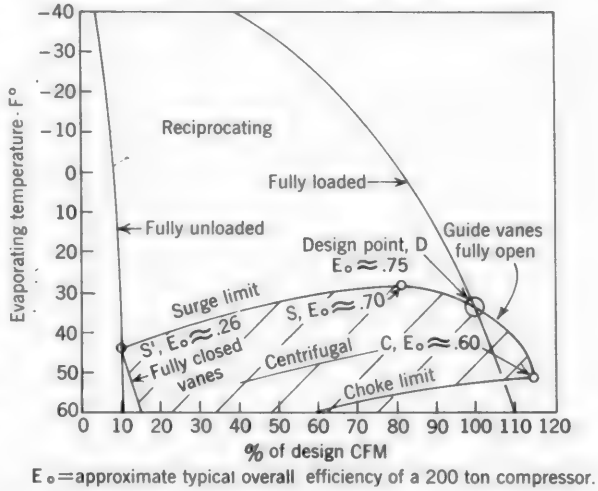
1. Positive displacement, no surging, wide application band and use of high pressure refrigerant.

2. High speed capabilities due to absence of valves and reciprocating parts for maximum capacity per volume or weight of compressor.



E_o = approximate typical overall efficiency of a 200 ton compressor.

Fig. 4. Effect of condensing temperature (at 34 deg F evaporating temperature).



E_o = approximate typical overall efficiency of a 200 ton compressor.

Fig. 5. Effect of evaporating temperature (at 103 deg F condensing temperature).

Such a trend has already developed in the gas and air compressor industry both in this country and in Europe. It is conceivable that high speed positive displacement non-reciprocating compressors may ultimately displace both the centrifugal and reciprocating machines in certain refrigeration and air-conditioning applications.

• • •

Editor's Note: This article, written some months ago, looks toward the development of compact high speed centrifugal chillers as part of a long-range trend. Last month such a unit was introduced to the market by one manufacturer (see News of Equipment and Materials) thus bringing into actuality what is, in this article, not expected for some time, making some physical comparisons in the article regarding single-stage centrifugal chillers obsolete.

Why Turbulence Is Critical In Convective Heat Transfer

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New York, N. Y.

The role of fluid turbulence in determining convective heat transfer, particularly in the field of heating and air conditioning, is usually neglected. Its importance cannot be overstated. The author points to several situations in heating and air conditioning work where careful consideration of convection and fluid flow will pay off in coil performance, as specified!

THE MOTION OF FLUID FLOW in a horizontal pipe can be described, basically, as either (1) turbulent, *i.e.*, having a random eddying motion, or (2) streamline or laminar, in which the fluid particles flow in lines along the axis of the pipe. A single, dimensionless number, Reynolds number, indicates which type prevails for given conditions of velocity, density, and viscosity of the fluid, and for a given pipe or tube diameter.

In general, if the Reynolds number is above 2100, flow is probably turbulent; if below, streamline flow usually results.

For interested readers, the theory behind the role that turbulence plays in convective heat transfer appears in most heat transfer texts. For our purpose here, a brief summary will do:

1. In turbulent flow, inside film coefficient is a function of Reynolds number and is usually of such magnitude in a cooling or heating coil that the air side has the smaller, and therefore controlling, film coefficient in the overall U-factor.

2. In streamline flow, heat transfer depends primarily on conduction, not convection, resulting in a very sharply reduced film coefficient, hence a much lower U-factor than in turbulent flow.

Of practical concern to engineers is the situation where the capacity of heating or cooling coils is reduced in the absence of turbulence.

High Viscosities, Low Capacities

Fluid viscosity takes pre-eminence over the other factors that influence convective heat transfer, especially because streamline flow is so often the result of high values of absolute viscosity. As fluid temperature falls, absolute viscosity usually goes up and Reynolds number goes down. Most problems in heat transfer, therefore, that arise from high viscosity, occur in cooling applications. Many anti-freeze brines, such as the aqueous glycol solutions, have an absolute viscosity several times that of chilled water and may be expected to produce radically lower capacities when used in the same cooling coil or heat exchanger.

For instance, in lieu of chilled water, use of an aqueous ethylene glycol solution of 35% by volume in a commercial six-row chilled water cooling coil, at a velocity of approximately 2 fps, would bring about a reduction in cooling capacity of approximately 60%! This is very typical of the acute drop in capacity that occurs when flow changes from turbulent to steamline when a more viscous cooling medium is used.

Low Velocities, Poor Control

The engineering significance of fluid velocity on turbulence, hence on convective heat transfer, is of importance second only to viscosity. In most cases, density and viscosity do not change much in going through a coil or heat exchanger. But velocity changes when flow is throttled by a modulating control valve. Reynolds number, proportional to velocity, may be reduced enough to change turbulent flow to streamline. This makes control a problem because there is such an abrupt drop in heat transfer. One answer is to make certain that initial design fluid velocity is high enough so that throttling does not result in streamline flow.

Even in the turbulent range, a decrease in velocity may change the heat transfer picture sufficiently to require that coil surface be appreciably altered. For example, I-B-R requires baseboard heating coils to be rated on 1 fps and 5 fps for the same mean water temperature and entering air conditions. Use of the lower velocity may dictate up to 7% increase in finned length of baseboard to do the same job.

When coils or heat exchangers are sized for future loads, velocity for present use should be carefully checked. If it is low enough to cause streamline flow, one remedy is to choose a coil with fractional circuiting or a heat exchanger with more passes to bring initial velocity into the turbulent range. The penalty, usually small, is higher pressure drop.

Contrary to popular belief, specific heat is *not* directly involved in the role of a turbulence as related to convection. But it does determine the mass rate of flow required to do a given job and, therefore, sets the *fluid velocity* for any given temperature differential, fluid density and pipe diameter. This may indirectly have important consequences as to whether turbulent or streamline flow results.

Artificially Induced Turbulence

Turbulence may be artificially induced by making the fluid change direction inside the tube. The resulting scrubbing action of the fluid increases heat transfer. Insertion of helically wound swirl strips into the tube constitutes one method employed to induce turbulence. By inserting swirl strips, tradenamed Turbulators, into his coil tubes, one manufacturer gets an increase in coil capacity of approximately 10-50%. Although pressure drop increases, a larger pressure drop would actually be incurred by raising the velocity high enough to obtain the same heat transfer as that acquired through induced turbulence. In terms of economics and space requirements, a coil designed with artificial turbulence may require less rows than one of conventional design.

How valuable induced turbulence can be is well illustrated in the following case history: A plant used large quantities of aqueous process brine at a temperature of approximately 19 deg F. It was decided to air condition a new office building on the premises using this brine as a cooling medium for this system. After the system was installed, it was found that cooling capacity at the coil was about 50% deficient to handle the specified design load for the building. Prolonged investigation finally revealed that streamline flow had developed in the cooling coil because of the high viscosity of the brine, and this accounted for the precipitous loss of cooling capacity.

The sales engineer for this air conditioning equipment had never calculated the Reynolds number, which would have shown the flow to be well in the streamline range; rather, he has just tacked on 15% as a safety factor to cover the use of brine instead of chilled water. Fortunately, the coil was of the cleanable-tube type and the owner was able to insert swirl strips in each tube. This induced turbulence enabled the coil to approach design capacity at a minimum of expense and effort for the owner.

In Perimeter Units

One final application in which turbulence plays an important role is to be found in using anti-freeze solutions in perimeter systems. One manufacturer of perimeter induction units says that use of aqueous ethylene glycol, 33⅓% by weight, for 0 deg freezing point, in lieu of water reduces the secondary water coil capacity of these units as follows:

For 20 inch and 28 inch units, as much as 67%; and for 36 inch and 48 inch units, as much as 55%.

This is due primarily to one factor: Streamline flow develops when ethylene glycol solution is used in these coils at design flow rates, and heat transfer is thereby sharply cut. In fact, this usually precludes the use of ethylene glycol for this application. Consequently, other methods for winterizing so-called "chilled water" systems, of which perimeter units are an integral part, seem clearly warranted.

In conclusion, when selecting coils or heat exchangers at low design velocities or with viscous fluids, always check the Reynolds number. Should streamline flow be indicated, the coil or heat exchanger capacity is sure to be seriously reduced; and its manufacturer ought to be consulted for an exact rating.

Convenient Formulae for Reynolds Number

$$N_{Re} = \frac{50.7\,Q\rho}{d\mu} = \frac{35.5\,B\rho}{d\mu} = \frac{6.32\,W}{d\mu}$$

where

N_{Re} = Reynolds number, dimensionless
Q = rate of flow, gpm
ρ = density of fluid, lb per cu ft
d = internal diameter of pipe, inches
μ = absolute viscosity of fluid, centipoises
B = rate of flow, barrels per hr
W = rate of flow, lb per hr

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INLETS AND OUTLETS—I

How Inlets Affect Fan Performance

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SKILLFUL USE OF AIR can be made to solve many problems. Air may be made to capture fumes or other contaminants for their removal from an operation to protect the operator. Air can be used to remove refuse, such as shavings and sawdust, from heavy production machinery. Air can transport materials from one location to another, as in pneumatic conveying systems. Thousands of tons of clean, heated or cooled air are circulated daily as a vital part of manufacturing processes. Wherever air is exhausted, it is make-up air that restores balance to the ventilation system. An ingenious engineer can devise countless methods of employing air to help him get his job done. The design of these systems requires not only knowledge of the characteristics of air, hood and duct design, but of the prime mover—the fan.

In all air moving systems, the fan—whether scroll-type centrifugal, airfoil centrifugal fan with in-line air flow, or axial flow—does not accomplish its purpose unless it is connected to duct work to confine and control the movement of air. A fan, therefore, is an integral part of a complete system. As a matter of fact, a delicate relationship exists between the fan and the system. The output of the fan—volume and pressure—is exactly accepted by the duct system—no more, no less. It is important that we understand this clearly because the duct system to which the fan is connected is the responsibility of the system design engineer and the fan design and selection is the responsibility of the fan engineer.

In effect, air moving systems consist of two components; the fan and the rest of the system—inlet louvers, filters, coils, ducts and grilles or blending units in the case of ventilation or air conditioning or hoods, ducts and contaminant collectors in the case of industrial air moving systems. A successfully operating system requires the utmost in cooperation between the system engineer and the fan engineer.

To visualize the delicate relationship existing between the fan and the rest of the system, the characteristic curves of each and their relationship should be studied. It is well known that fans can be completely characterized by a simple set of volume-pressure and volume-horsepower curves (Fig. 1). The useful portion of the volume-pressure curve occurs to the right of the peak pressure. For larger volumes the pressure potential of the fan reduces until at maximum volume delivery the pressure is zero. The volume-pressure curve, therefore, is sloping downwards to the right.

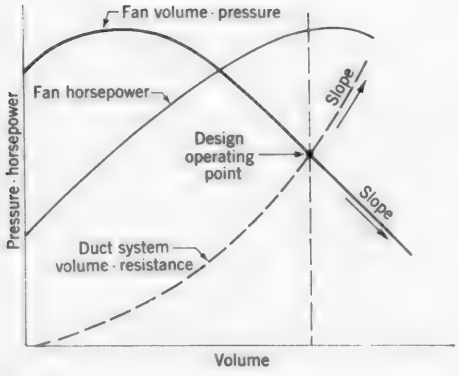

Fig. 1. Typical curves of fan and duct system.

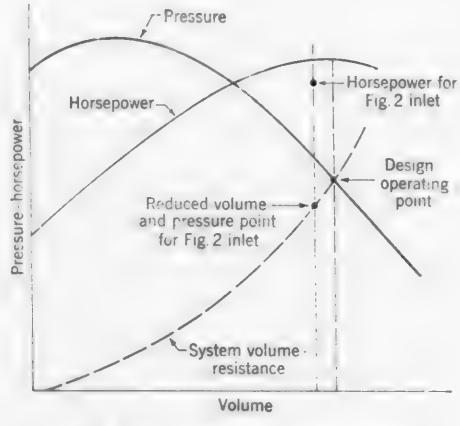

Fig. 2. Elbow inlet cuts fan capacity.

The duct system can also be characterized by a system curve also shown in Fig. 1. The system resistance to the flow of air varies parabolically. The resistance, therefore, rises at an increasing rate as the flow increases—the curve is sloping upwards to the right.

The fan volume-pressure curve must intersect the system resistance curve and this juncture is an operating point of the fan upon the duct system. This juncture is the only point on the two curves that is common to both. The volume output of the fan is exactly accepted by the system as before stated. Any disturbance to the fan—inside or outside it—may affect its volume output and, of course, the flow through the duct system.

Fans are tested in accordance with standards as determined by AMCA (Air Moving and Conditioning Association). In these procedures, straight air flow is prescribed both entering and leaving the fan and is

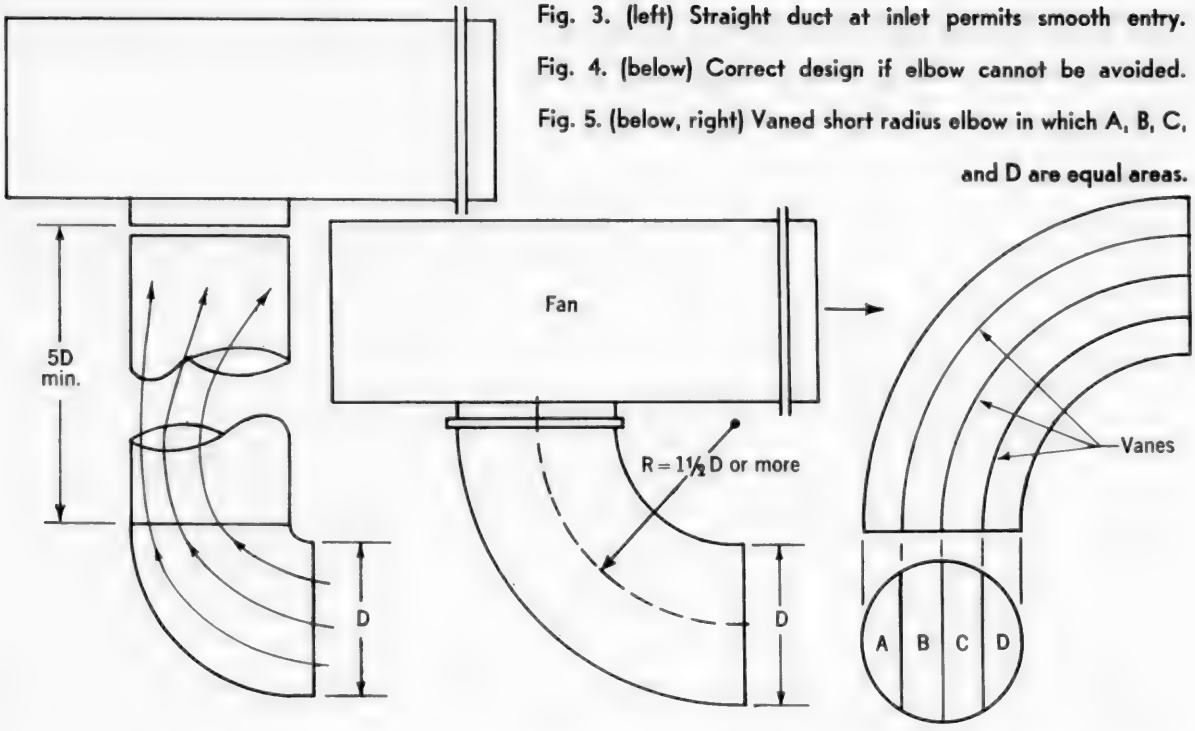

Fig. 3. (left) Straight duct at inlet permits smooth entry.

Fig. 4. (below) Correct design if elbow cannot be avoided.

Fig. 5. (below, right) Vaned short radius elbow in which A, B, C, and D are equal areas.

considered "standard." "Standard" fan connections must insure straight air flow. Other types of flow, such as entrance spin and turbulence-creating connections, will reduce the fan and system performance. Extremely poor connections to a fan may reduce the air flow as much as 50% or even more! An understanding of the fan and system is not enough. We must be aware of the effects of these "nonstandard" connections.

"Nonstandard" connections may be unavoidable on the part of the designing engineer due to space conditions, duct configuration, or for other reasons. The installer may revise the duct layout during erection and create unfavorable conditions or perhaps the fan is of the incorrect rotation or discharge. In any event, the malfunctioning of a system may be caused by improper nonstandard fan connections.

It is also important to understand that the variety and type of connections are limitless. It is impossible to review all of them; however, an understanding of the general types of connections will enable us to evaluate the variations. Furthermore, the air density, velocity, and type of fan will also affect the degree of disturbance. A broad review of typical connections will follow to acquaint us with possible problems.

By far and large, most systems involve single inlet fans requiring sheet metal connections. Inlet elbows are most common, in fact, almost unavoidable. The degree of their effect upon the fan will depend upon their size, radius, air velocity and density. Since air has mass, centrifugal force will tend to "throw" the air to the outside radius of the elbow. More air is entering one side of fan inlet than the other, creating an unbalanced load of the fan wheel.

Unequal entrance of air into the wheel blading means that all the blades are not equally effective. Less work is done by the blades at the inner radius and more by the blades at the outer radius. However, a balance is not maintained and the result is less work done on the air. The volume and pressure boost of the fan is reduced, as shown in Fig. 2. The shorter the centerline radius of the elbow, the more severe is its effect in reducing the performance.

How should we correct inlet elbow performance reduction? Air flowing at a medium velocity through an elbow will generally straighten itself out in a length of duct equal to about five duct diameters. (Higher velocities require a longer straightening duct.) The concentration of the air at the outside of the elbow will redistribute itself to more completely fill the duct in this distance. It is advisable to consider the redesign of the system by moving the inlet elbow five diameters or more away from the fan to allow "standard" inlet conditions to be approached (Fig. 3).

The concentration of air at the outside of the elbow is reduced as the elbow radius is increased and accordingly the fan performance is improved. The centerline radius of the elbow (R) should *never* be less than 1½ duct diameters, and larger, if possible (Fig. 4).

If a short radius elbow is inevitable due to space limitations, then its poor effect on fan performance can be minimized by installing three vanes to divide its cross section into four equal areas as in Fig. 5. Vaning a round elbow is difficult to accomplish mechanically, but may be justified on occasion. However, caution must be exercised when the system is handling abrasive or bulky material as excessive wear or clogging of the vanes may occur.

ESTIMATING

Job Time Reference

Part 5 in this series on estimating continues the publication of a group of tables containing specific estimating data in terms of man-hours of labor. Instructions for proper application of these tables are outlined in the accompanying text.

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TODAY IN INDUSTRIAL WORK, the contractor may be required to install piping systems utilizing stainless steel piping, plastic, or plastic-lined piping in addition to the standard piping materials such as steel, brass, copper or cast iron. Starting with stainless steel, we will try to show the number of man-hours involved in installing these types of pipe and fittings.

TABLE 10 — STAINLESS STEEL PIPE AND FITTINGS — POWER TOOL OPERATION TIME

Pipe Size, Inches	Cut Pipe		Cut and Thread Pipe		Cut and Thread Pipe, Make on Screwed Flange and Reface				V-Type Bevels for Field Welding		Backweld Screwed Connections	
					Schedule 40		Schedule 80					
	Minutes	Man-Hours	Minutes	Man-Hours	Minutes	Man-Hours	Minutes	Man-Hours	Minutes	Hours Man-	Minutes	Man-Hours
¾	3.6	.060	7.14	.119	—	—	—	—	—	—	—	—
1	3.84	.064	7.68	.128	49.80	.830	53.88	.898	2.16	.036	18.9	.315
1¼	4.14	.069	8.22	.137	51.24	.854	56.58	.943	2.70	.045	20.3	.338
1½	4.38	.073	8.76	.146	53.88	.898	61.98	1.033	3.30	.055	24.3	.405
2	4.68	.078	9.30	.155	59.28	.988	67.44	1.124	4.26	.071	31.1	.518
2½	4.92	.082	9.84	.164	64.68	1.078	72.24	1.204	5.34	.089	39.8	.664
3	5.22	.087	10.38	.173	74.94	1.249	83.04	1.384	6.42	.107	51.3	.855
3½	6.42	.107	12.84	.214	81.00	1.350	93.84	1.564	7.56	.126	64.8	1.080
4	7.32	.122	14.68	.248	91.14	1.519	99.24	1.654	8.58	.143	67.5	1.125
5	8.40	.140	21.60	.360	94.50	1.575	107.34	1.789	10.80	.180	68.1	1.135
6	10.80	.180	28.38	.473	104.64	1.744	119.14	1.969	12.90	.215	83.8	1.395
8	19.26	.321	47.28	.788	121.50	2.025	141.06	2.351	17.22	.287	102.60	1.710
10	30.06	.501	74.28	1.238	150.54	2.509	172.14	2.869	21.54	.359	——	——
12	41.16	.686	116.76	1.946	185.64	3.094	209.94	3.499	29.10	.485	——	——

Note: Add 50% for use of hand tools.

Data

Stainless steel pipe takes more time to install because stainless steel is tougher than regular steel pipe, thereby taking more time to work with. Then it is generally necessary to use greater care to make up this material in order to keep from marring the pipe and to preserve the appearance. See Tables 10, 11 and 12.

Plastic-lined pipe is used where corrosive liquids and gases are encountered. It is widely used, and is highly successful in combating corrosion. Mechanically it is just as strong as the other metals and can be used with temperatures up to 194 deg F.

Pipe can be cut and threaded almost as easily as ordinary steel pipe using conventional hand or power tools. However, it is very important that the cuts be accurate and square, and the machining be carefully done.

Table 13 will give an idea of the time required to install this material.

Plastic pipe and fittings are used for handling chemicals, acids, gasoline, salt and fresh water, to mention only a few. It is also used for conduit and drainage piping. It is also widely used on sprinkler systems for home lawns and golf courses.

Pipe is furnished in iron pipe sizes threaded or pre-jointed with screwed fittings, and comes in 20 ft lengths. It is normally designed for 75 lb working pressure, but can be procured to handle pressures up to 150 lb. Plastic pipe and fittings, being much lighter in weight than either steel or iron pipe and fittings, make it easier to handle and quicker to install. However, in some sections of the country union requirements

TABLE 11 — SCREWED STAINLESS STEEL PIPE AND FITTINGS — INSTALLATION TIME

To Install	¾"	1"	1¼"	1½"	2"	3"	4"	6"	8"	10"	12"
	Time in Man-Hours										
Lineal Foot—Type 304 Schedule 40 Pipe	.225	.225	.304	.304	.304	.338	.450	.675	.90	1.13	1.35
Lineal Foot—Type 304 Schedule 80 Pipe	.281	.281	.337	.337	.337	.563	.675	.90	1.13	1.35	1.58
90°-45° Elbows	.675	.900	1.13	1.13	1.88	4.05	4.73	5.85	7.50	—	—
Tees	1.013	1.13	1.69	1.69	2.14	6.08	7.09	8.78	10.13	—	—
Unions	.675	.900	1.13	1.13	1.88	—	—	—	—	—	—
Flanges	.788	.900	.900	1.013	1.24	2.36	2.59	3.15	3.60	—	—
Reducers	.675	.900	.900	1.13	1.69	4.05	4.73	5.85	6.76	—	—
Nipples	.225	.225	.225	.338	.45	.563	.563	.675	.788	—	—
Strainers	.90	1.13	1.13	1.35	1.91	4.28	4.95	—	—	—	—
Traps	1.13	1.24	1.24	1.46	2.03	3.83	5.06	—	—	—	—
Valves	1.013	1.013	1.013	1.24	1.80	4.61	5.40	7.65	8.78	—	—

TABLE 12 — SPECIAL STAINLESS STEEL WELDING FITTINGS

Pipe Size, Inches	Coupling Nozzle Welds				Welding Socket Fittings, Per Connection		Threadolets or Weldolets		Pads	
	Standard		Extra-Heavy							
	Time in Man-Hours									
¾	47.4	.79	91.2	1.52	32.4	.54	82.8	1.38	96.6	1.61
1	54.0	.90	108.0	1.80	35.8	.596	91.0	1.52	112.8	1.88
1¼	60.6	1.01	134.4	2.24	40.5	.675	102.0	1.70	129.0	2.15
1½	68.4	1.14	168.6	2.81	47.3	.788	118.2	1.97	150.6	2.51
2	90.0	1.50	210.6	3.51	54.7	.911	147.6	2.46	188.4	3.14
2½	118.2	1.97	259.8	4.33	65.4	1.09	193.8	3.23	237.0	3.95
3	148.8	2.48	313.8	5.23	78.6	1.31	247.8	4.13	258.6	4.31
4	183.6	3.06	438.6	7.31	120.0	2.00	—	—	—	—
6	220.8	3.68	—	—	168.6	2.81	—	—	—	—

Note: For couplings or nipples installed at other than 90° angles, add 50% to the above man-hours.

TABLE 13 — PLASTIC-LINED PIPE AND FITTINGS — INSTALLATION TIME

To Install	1"	1¼"	1½"	2"	2½"	3"	4"	6"	8"
	Time in Man-Hours								
Lineal Foot—									
Flanged Pipe	.25	.30	.35	.45	.55	.65	.75	1.10	1.75
Flanged Tees	3.00	4.00	6.00	7.00	9.00	11.00	17.00	21.00	27.00
Flanged Elbows	2.25	3.00	4.00	4.50	6.00	7.50	11.00	14.00	18.00
Flanged Cross	3.50	4.50	7.50	9.00	12.00	15.00	22.00	28.00	36.00
C.I. Flange and Bolt-up	1.00	1.75	2.25	2.50	3.00	3.75	5.60	7.00	9.00
Flanged Reducer	2.25	3.00	4.00	4.50	6.00	7.50	11.00	14.00	18.00
Flanged Valve	3.60	4.10	5.70	7.40	9.80	11.70	15.50	22.40	29.00

Note: For each fitting, a field constructed stub end threaded for each outlet is required and must be cut to fit. The time shown above includes handling, threading, make-on and bolt-ups. Valve time includes two flanges and bolt-ups, jointing and erection.

JOB TIME REFERENCE DATA

TABLE 14 — RIGID PLASTIC PIPE AND SCREWED FITTINGS — INSTALLATION TIME

To Install	Time in Man-Hours										
	½"	¾"	1"	1¼"	1½"	2"	2½"	3"	4"	5"	6"
Ells & Sweeps	.25	.30	.40	.50	.50	.75	.75	1.80	2.10	2.10	2.60
Tee	.40	.45	.50	.75	.75	.95	.95	2.70	3.15	3.15	3.90
Adapter	.24	.28	.36	.50	.50	.52	.52	1.20	1.90	1.90	2.30
Coupling	.18	.21	.27	.38	.38	.39	.39	.90	1.42	1.42	1.72
Plug & Cap	.08	.10	.13	.17	.17	.25	.25	.60	.70	.70	.86
Saddle	.25	.28	.36	.50	.50	.52	.52	1.20	1.90	1.90	2.30
Flange	.30	.35	.40	.45	.45	.55	.55	1.05	1.15	1.25	1.40
Valve	.30	.35	.45	.55	.55	.80	.80	2.05	2.40	2.80	3.40
Reducer	.25	.30	.40	.50	.50	.75	.75	1.80	2.10	2.60	3.00
Lineal Foot—											
Threaded Pipe	.09	.09	.09	.12	.12	.14	.14	.14	.18	.25	.30

Note: Time for cutting and threading plastic pipe, when required for shorter lengths, is approximately one-third that for steel pipe.

TABLE 15 — PLASTIC PIPE AND CEMENTED FITTINGS — INSTALLATION TIME

To Install	Time in Man-Hours										
	½"	¾"	1"	1¼"	1½"	2"	2½"	3"	4"	5"	6"
45° & 90° Elbows	.10	.12	.18	.30	.30	.40	.60	.80	1.0	1.10	1.10
Tees	.13	.17	.25	.48	.64	.83	1.00	1.00	1.20	1.23	1.25
Adapters	.08	.11	.16	.30	.30	.33	.59	.73	.87	.93	1.03
Saddle	.09	.09	.13	.27	.27	.37	.47	.60	.60	.74	.83
Reducer	.09	.12	.18	.30	.30	.37	.60	.73	.73	.93	1.03
Cap	.03	.03	.07	.13	.13	.20	.23	.33	.37	.47	.60
Valve	.13	.16	.21	.37	.37	.43	.80	.93	1.03	1.20	1.33
Lineal Foot—											
Plain Pipe	.06	.06	.06	.08	.08	.09	.09	.09	.12	.17	.20

demand that the cost of installation be charged at steel pipe rates. Table 14 gives an indication of the true time involved in handling threaded plastic pipe and screwed fittings.

Where plastic pipe and cemented (socket) fittings are used, care must be taken to make sure that the pipe is squarely cut to insure a tight bond with the fitting. The outside of the pipe and inside of the fitting are brushed with cement and the pipe is then inserted into the fitting. After being allowed to set, the resulting effect will be a thoroughly tight joint. This type of material will not rot or rust, and will be very effective against electrolytic action. Table 15 will give an idea of the time involved to install this type of pipe & fittings.

The author would like to stress that the foregoing tables are not by any means the complete answer for every estimator. They can, however, establish a basis for estimating labor for the materials shown.

There are too many factors to be considered to make any set of tables foolproof, and for this reason the reader will have to analyze these performance tables and compare them with his own records.

As the writer has stated before, there are so many different rules and regulations covering building procedure and union regulations applying to the application of labor that only if the reader will take the trouble to adjust these tables to conform with conditions in his own area will they be of any use. These tables, in general, contain maximum values of man-hours, reflecting labor performance in the larger metropolitan areas. An easily calculated factor, based on past experience, applied to these published data can convert them to any geographical area or quality of labor performance.

Next month, Job Time Reference Data will cover installation time for big-building centrifugal pumps and sump pumps.

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STEAM TRAP SELECTION

Why use a trap
What type to use
How to size traps
Aids to installation
When trouble occurs

August, 1961

AIR CONDITIONING, HEATING AND VENTILATING's
REFERENCE SECTION

A STEAM TRAP PROPERLY APPLIED can help maintain high efficiency in your steam heated equipment. The trap, when operating properly, will keep your process or service equipment close to steam temperature, thereby permitting a maximum rate of production. However, if the trap is not functioning properly, it can be a constant source of annoyance.

Malfunction can be caused by a failure within the trap but, more important, malfunction can be caused by misapplication or faulty installation. Improper application and installation can impose unusual operating conditions. The unusual conditions in turn can restrict the ability of the steam trap to function as expected. Excessive wear may also become a problem through malfunctioning.

Why Use A Steam Trap

To obtain the greatest benefit from a steam trap, it is first necessary to understand why a steam trap is needed. The name steam trap implies one function —that is, to restrict the flow of steam. However, this can be done by any throttled valve. There is a more important need, and if you have ever experienced condensate backing up in equipment, you will know that a steam trap should drain all the condensate from your equipment. A throttled valve can also do this, but it requires labor to operate the valve and watch a water gage. Therefore, the steam trap must discharge condensate and non-condensible gases (such as air) quickly and automatically, and do both efficiently and economically.

Heat transfer equipment utilizes the heat of one medium in heating another medium. In the case of steam, its heat is usually transferred through a metallic wall to a gas, liquid, or solid depending on the process. When the steam gives up heat, it condenses to form water or condensate. This liquid lying in the steam lines lowers the heat transfer efficiency in addition to absorbing the heat of new steam coming into the equipment. Steam contacting excessive quantities of sub-cooled condensate can cause damaging water hammer. Therefore, to obtain maximum efficiency, the condensate should be removed as quickly as possible, even though it is still hot, since most of its useful heat has been given up during condensation.

John Scott graduated from Drexel Institute of Technology in 1952 with a BSME. He is a native of Philadelphia and served with the U. S. Army Air Corps before entering Drexel. Before coming to Yarnall-Waring Co. as a valve engineer, he worked with the Glenn L. Martin Co., and the Gulf Oil Corp. In February, 1958, he advanced to engineering section leader in charge of steam traps, expansion joints and strainers for the company. In this capacity, he and his section are responsible for design improvements of existing products, and design and development of new products.

Types of Steam Traps

There are two major steam trap categories—lift or boiler return and non-return. The first category discharges condensate at pressures equal to or greater than the pressure at the trap inlet. These traps are often limited in application, large and costly. The non-return trap discharges condensate at pressure lower than that at the trap inlet, many times directly to the atmosphere. This category is by far the most widely used and will be the type discussed here.

Within the basic category of non-return steam traps, three groups are available, and each group has several different types. These groups and types are shown on page 77.

When trying to define the limitations of a particular trap group or type, general statements are mandatory. If you suspect that a particular trap will not meet your requirements, consult the manufacturer's catalog. Essentially, every type of steam trap will do the required job when applied correctly. It is the limits in application with which we are concerned.

Mechanical group traps have the ability to handle large capacities, particularly at relatively low pressures. They are sensitive to changes in the condensate flow rate and are capable of discharging condensate at or near steam temperature. The ball float steam trap is suitable for use where continuous discharge is desirable. In general, the operating pressure range of bucket or inverted bucket traps is limited by the area of the internal valve. For example, one catalog for a bucket trap shows capacity of 690 lb per hr at 20 psi, while the capacity at 30 psi is 500 lb per hr. You can see that the internal seat orifice had to be reduced to offset the effect of higher pressure keeping the valve shut.

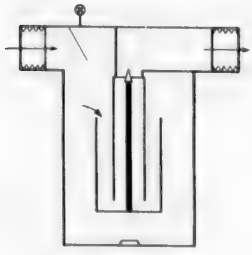
When mechanical traps are installed outdoors, they require protection against freezing since they are not self-draining. The air handling ability of mechanical traps is not as good as others, except when provided with special venting. In the case of special venting, using a thermostatic device, air handling is good. However, as the system warms up, the vent must close off before steam reaches the trap. Otherwise, useful steam will be permitted to escape through the vent. In the event that the vent closes before steam temperature condensate reaches the trap, air remaining in the system may be trapped, thus reducing efficiency and increasing start-up time. Open bucket and inverted bucket traps require priming. Loss of prime results in steam blow through.

Thermostatic group traps have excellent air handling ability but can be subject to the condition described above. These traps are usually self-draining, hence not subject to freezing when installed outdoors. Their condensate handling capacity is also good. Metallic or liquid expansion type traps are suit-

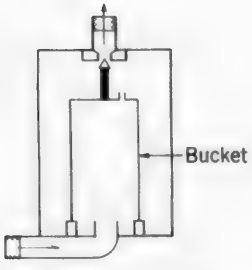
Basic Groups and Types of Steam Traps

Mechanical Group

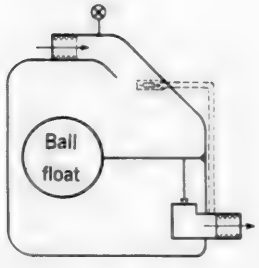
Operates through use of levers actuated mechanically by the difference in density of steam and water



Open bucket



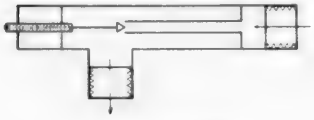
Inverted bucket



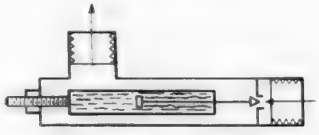
Ball float

Thermostatic Group

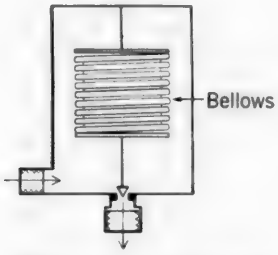
Operates by means of the thermal expansion rate of solid and/or fluid due to changes in temperature



Metallic expansion



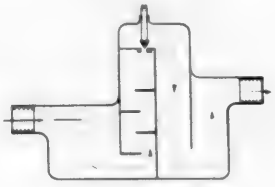
Liquid expansion



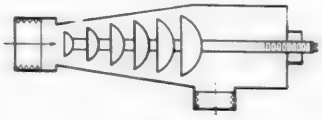
Bellows or balanced pressure

Thermodynamic Group

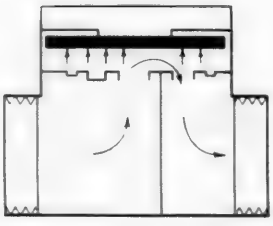
Operates by making use of the differences in internal energy of steam and condensate



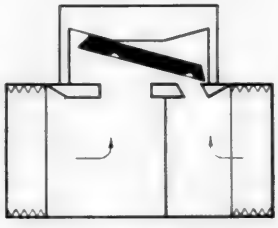
Labyrinth



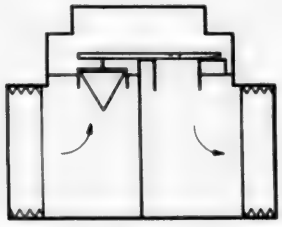
Orifice



Kinetic energy



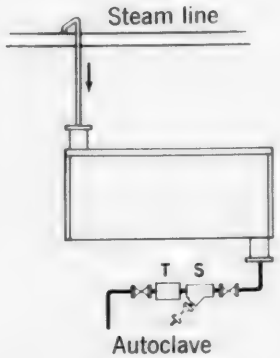
Impulse, low capacity



Impulse, high capacity

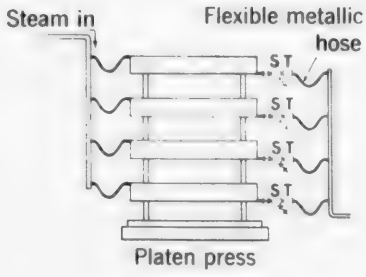
It should be pointed out that this schematic tabulation is a simplification of available steam traps. Some traps may incorporate features from several of these groups. For example, some inverted bucket traps use an air vent that is actuated thermostatically.

Specific Steam Trap Applications Have



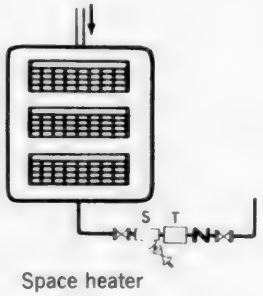
$C = WSX$

(used for pressure vessels such as retorts, autoclaves, etc., where steam is applied directly to a solid material being heated)



$$C = WX + 970\frac{(W-D)}{L}$$

(used for dryers, platen presses, etc., where steam loses its latent heat indirectly to a solid material through a metallic surface)



$C = AY$

(used for unit heaters, chamber dryers, etc., where steam loses latent heat indirectly to air through a metallic surface)

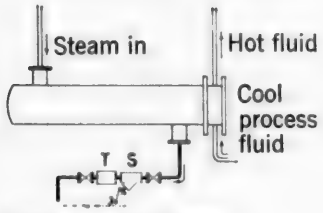
Symbols Used

A = Heating area in sq ft (see Table 1 for pipe)
B = Weight of liquid being heated, lb/gal
C = Condensate rate, lb/unit time
D = Weight of substance heated after drying, lb
G = Liquid heated, gal/unit time
H = Heat loss, Btu/sq ft/deg F/hr
K = Coefficient of heat transfer (see Table 3)
L = Latent heat of steam at trap pressure, Btu/lb (see Table 4)
S = Specific heat of substance being heated (see Table 5)
X = Arbitrary Factor $= \frac{T-t}{L}$ (see Table 6)
where $(T-t)$ is temperature rise of substance being heated, deg F
Y = Radiation from heating surface (see Table 7)
$= H\ (t_1 - t_2)/L$, lb/hr/sq ft
t_1 = Steam temperature at trap, deg F
t_2 = Ambient air temperature, deg F

able for continuous discharge conditions. Under conditions of constant pressure and temperature, the balanced pressure trap is likewise suitable, but usually discharge is intermittent. The thermal expansion element tends to cause throttling as the temperature rises, shutting off only at a specific temperature. In order to assure that steam is not lost, complete shut-off usually occurs at some temperature well below steam temperature. This results in the need for a "cooling leg" ahead of the trap. Adjustments for changes in operating pressure are necessary, particularly if the pressure (hence temperature) is decreased in liquid or metallic expansion types. These traps are not recommended for draining superheat lines. They are generally not sensitive to changes in condensate flow rate.

Thermodynamic group traps discharge condensate at or near steam temperature, thereby ridding the equipment of condensate almost as soon as it is formed. Hence, they are sensitive to changes in condensate flow rate. This group has a wide operating pressure range, some having primary ratings up to

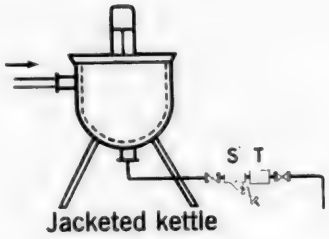
Specific Sizing Formulas



Shell and tube heater

$C = KAX$

(used for submerged surfaces where quantity of liquid heated is unknown)



Jacketed kettle

$C = GBSX$

(used for cookers, heat exchangers, etc., where steam loses heat to submerged surfaces and the quantity of liquid heated is unknown)

When the quantity of air and its entering and leaving temperature are known, Table 8 can be used for estimating condensate rate from air blowing over steam coils. If this information is unknown, use Formula 3 ($C = AY$) and apply a factor of 5.

In the case where a submerged surface (as in heat exchangers) has more area than needed to heat the liquid within the given time, use Table 2 directly, provided the condensate is removed rapidly. The condensate is found by multiplying values in the table by square feet of heating surface and a use factor.

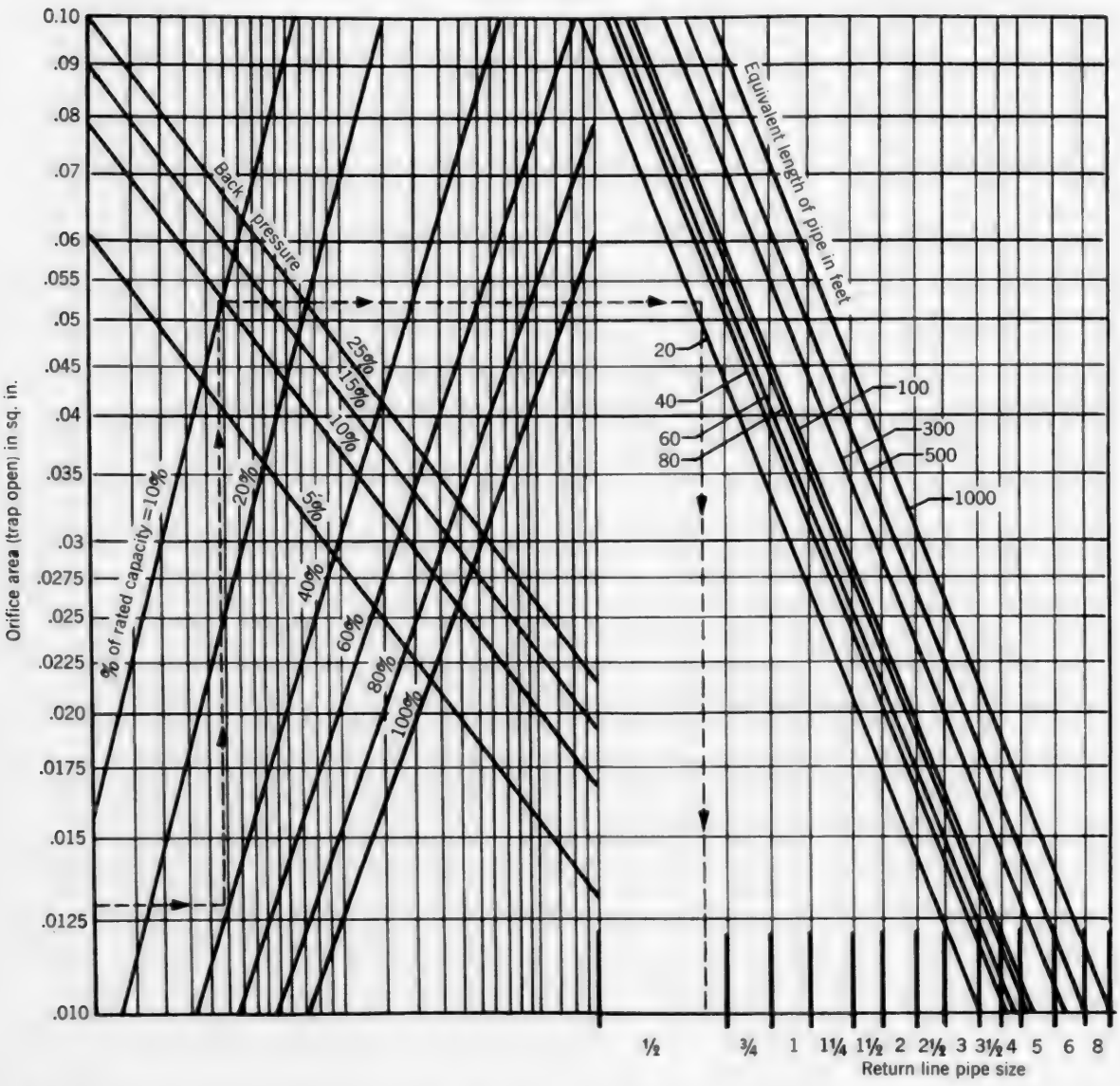
2500 psi. The labyrinth trap requires adjustment for changes in pressure. The kinetic trap requires no adjustment. Some impulse types require a simple adjustment for pressures below 20 psi.

This group, in general, is self-draining and requires no protection against freezing. Air handling ability is very good. The impulse trap continuously samples condensate reaching the trap as does the labyrinth trap. The impulse trap opens only on condensate. The kinetic energy trap is designed to shut off tight, opening only when steam in the bonnet condenses and lowers the pressure over the disc. The condensing action is a function of radiation through the bonnet; hence when installed outdoors, rain or cold air tends to make the trap open more frequently.

Condensate Load

Perhaps the most important factor in selecting the steam trap for any application is determining the condensate load. Steam becomes condensate or water by giving up heat in a number of ways such as: (1) directly to a solid in pressure vessels as in autoclaves,

Use This Chart to Size Steam Trap Return Lines



To size return lines to prevent excessive back pressure, this chart can be used. "Percent of rated capacity" is equal to 100% divided by safety factor used. Desired maximum back pressure determines next point. Length of return line locates point where vertical is dropped to find the return line pipe size.

Dotted lines trace a typical case. Here, trap requires area equivalent to about 80% of area of a ½-inch pipe, since intersection lies about 80% of the distance between zero and full ½-inch pipe size. Add unit areas together to find total area of return line. Nearest larger pipe size should be used.

sterilizers, retorts, etc.; (2) indirectly to a liquid through a submerged heating surface as in heat exchangers, cooking kettles, etc.; (3) indirectly to air through pipe or tube and fins as in radiators, unit heaters, chamber dryers, etc.; and (4) indirectly to solid materials through metal surfaces as in paper dryers, drum dryers, platen presses, etc. For each method of heat transfer there are three separate condensate loads to consider.

Start-up load requires important consideration because this determines how fast a process can be brought up to temperature. During start-up the ability to handle cold condensate and non-condensible gases is important, because the system is cold and

TABLE 1—EXTERNAL AREA OF STANDARD PIPE PER FOOT OF LENGTH

Pipe Size, In.	Area, Sq. Ft.	Pipe Size, In.	Area, Sq. Ft.
½	0.22	4	1.2
¾	0.28	6	1.7
1	0.34	8	2.3
1¼	0.44	10	2.8
1½	0.50	12	3.3
2	0.62	14	3.9
2½	0.75	16	4.5
3	0.92	18	5.0

condensate forms at a great rate, resulting in lower pressures at the steam trap. This somewhat suppressed pressure reduces the ability of the trap to discharge as effectively as might be expected and when combined with abnormal quantities of air, a heavy load is created at low pressure. Thus, with batch or intermittent processes, special attention should be given to start-up conditions.

Normal and abnormal operations are the other two factors. Condensate formation rate is relatively constant under normal conditions. Fast, efficient condensate removal is of prime importance. With abnormal conditions, such as changes in pressure or condensate rate, rapid steam trap response to these variations is needed. Continuous processes call for attention to those factors, and air handling ability is also important.

When considering the three operating conditions, give some thought to: (1) pressure and temperature at the trap inlet, (2) discharge temperature, (3) heat-up time, and (4) back pressure.

Most steam trap capacity tables are based on the pressure *at the steam trap,* not the pressure at the equipment or the boiler. The temperature of the condensate discharged from the trap is important when comparing these tables. For example, at 100 psig a one-square-inch orifice will handle almost six times as much 60 deg F water as steam temperature water (338 deg). Therefore, in order to prevent water from backing up in the equipment, steam traps with lower discharge tempertaures should be installed further away from the equipment drained, to permit further cooling of the condensate before it reaches the trap.

Heat-up time is important, but this is a two-way street. The steam trap capacity should equal at least the heaviest estimated condensate load. But, the processing equipment, piping, fittings, etc., must be capable of creating and passing the estimated condensate load to the steam trap at the estimated pressure. This was previously discussed under start-up conditions where cold lines and air reduce the trap's *expected* capacity. In most instances proper selection of safety factor takes care of this problem.

TABLE 2—CONDENSATE FORMED IN SUBMERGED STEEL HEATING ELEMENTS

Mtd†	Btu/sq ft/hr	Steam Pressure, Psig																
		5	10	15	20	25	50	75	100	150	200	250	300	350	400	450	500	600
		Condensate Formed, in Lb/Sq Ft/Hr*																
10	280	.29	.29	.30	.30	.30	.31	.31	.32	.33	.33	.34	.35	.35	.36	.37	.37	.38
20	930	.97	.98	.99	.99	1.00	1.02	1.04	1.05	1.08	1.11	1.14	1.16	1.18	1.20	1.22	1.24	1.28
30	1,900	1.98	1.99	2.01	2.02	2.03	2.08	2.12	2.16	2.22	2.27	2.32	2.36	2.41	2.45	2.49	2.53	2.61
40	3,100	3.23	3.26	3.28	3.30	3.32	3.40	3.46	3.52	3.62	3.72	3.78	3.85	3.92	3.99	4.06	4.13	4.25
50	4.500	4.68	4.73	4.76	4.78	4.82	4.93	5.02	5.11	5.25	5.38	5.48	5.58	5.69	5.80	5.89	5.99	6.17
60	6.250	6.51	6.57	6.62	6.65	6.69	6.86	6.97	7.10	7.30	7.47	7.62	7.76	7.92	8.06	8.18	8.33	8.58
70	8,000	8.33	8.41	8.46	8.52	8.57	8.77	8.93	9.08	9.34	9.56	9.75	9.94	10.15	10.32	10.47	10.65	10.97
80	10,400	10.83	10.93	11.00	11.06	11.13	11.40	11.61	11.80	12.14	12.43	12.67	12.92	13.17	13.40	13.62	13.85	14.26
90	12,500	13.00	13.13	13.23	13.30	13.37	13.70	13.95	14.20	14.60	14.94	15.24	15.53	15.83	16.13	16.36	16.65	17.15
100	15,000	15.62	15.75	15.86	15.95	16.05	16.44	16.75	17.03	17.50	17.90	18.28	18.63	18.97	19.34	19.64	19.97	20.57
125	22,400	23.30	23.53	23.70	23.85	23.95	24.55	25.10	25.45	26.15	26.75	27.30	27.80	28.35	28.90	29.30	29.85	30.73
150	30,000	31.20	31.50	31.70	31.90	32.10	32.90	33.50	34.10	35.20	35.85	36.60	37.30	38.00	38.70	39.30	39.95	41.15
175	40,000	41.65	42.00	42.30	42.60	42.80	43.80	44.30	45.40	46.70	47.80	48.75	49.70	50.65	51.60	52.40	53.30	54.85
200	50,000	52.10	52.50	52.85	53.20	53.50	54.80	55.80	56.75	58.30	59.70	60.90	62.10	63.30	64.50	65.50	66.60	68.60
250	82,000	85.30	86.20	86.70	87.25	87.75	90.00	91.60	93.10	95.70	98.00	100.00	102.00	103.70	105.70	107.30	109.30	112.50
300	100,000	104.00	105.00	105.70	106.30	107.00	109.50	111.60	113.50	116.60	119.40	122.00	124.20	126.50	128.80	131.00	133.30	137.00

* For copper, multiply table data by 2.0. For brass, multiply table data by 1.6. † Mean temperature difference, F = temperature of steam minus average liquid temperature. Heat transfer data for calculating this table obtained and used by permission of the American Radiator & Standard Sanitary Corp.

TABLE 3—TYPICAL RANGES OF OVER-ALL COEFFICIENTS OF HEAT TRANSFER

Type of heat exchanger	Free convection, K	Forced convection, K	Typical Fluid	Typical apparatus
Liquid to liquid	25- 60	150-300	Water	Liquid-to-liquid heat exchangers
Liquid to liquid	5- 10	20- 50	Oil	
Liquid to gas*	1- 3	2- 10	.....	Hot-water radiators
Liquid to boiling liquid	20- 60	50-150	Water	Brine coolers
Liquid to boiling liquid	5- 20	25- 60	Oil	
Gas* to liquid	1- 3	2- 10	.....	Air coolers, economizers
Gas* to gas	0.6- 2	2- 6	.....	Steam superheaters
Gas* to boiling liquid	1- 3	2- 10	.....	Steam boilers
Condensing vapor to liquid	50-200	150-800	Steam to water	Liquid heaters and condensers
Condensing vapor to liquid	10- 30	20- 60	Steam to oil	
Condensing vapor to liquid	40- 80	60-150	Organic vapor to water	
Condensing vapor to liquid	.....	15-300	Steam-gas mixture	
Condensing vapor to gas*	1- 2	2- 10	.....	Steam pipes in air, air heaters
Condensing vapor to boiling liquid	40-100	.....	.....	Scale-forming evaporators
Condensing vapor to boiling liquid	300-800	.....	Steam to water	
Condensing vapor to boiling liquid	50-150	.....	Steam to oil	

* At atmospheric pressure.
K = Btu/(hr)(sq ft)(deg F) Under many conditions either higher or lower values may be realized.

TABLE 4—LATENT HEAT OF STEAM

Pressure, psig	Btu per lb	Pressure, psig	Btu per lb
1	968	100	881
2	965	150	857
5	961	200	837
10	952	250	820
15	945	300	805
20	940	350	790
25	934	400	776
35	924	450	764
50	912	500	751
75	895	600	728

TABLE 5—SPECIFIC HEATS OF VARIOUS SOLIDS AND LIQUIDS

Solids		Liquids	
Aluminum	0.23	Alcohol	0.65
Brass	0.10	Carbon tetrachloride	0.20
Copper	0.10	Gasoline	0.53
Glass	0.20	Glycerin	0.58
Iron	0.13	Kerosene	0.47
Steel	0.12	Oils	0.40-0.50

Back pressure can be created a number of ways. Flashing steam is the prime offender with respect to steam traps. Hot condensate being discharged to a lower presure will flash or expand, creating an "unexpected" pressure rise in the return line. Therefore your capacity selection should take into account the differential across the trap. If the back pressure is too great, it may unbalance the forces in the steam trap causing it to remain open. As a general rule, the return piping should be larger than the piping to the steam trap. Under some conditions, it is desirable to use the hot condensate for other purposes within the plant. This is often done, but remember that improperly sized return lines will cause problems that will extend through all systems since capacities will be reduced. The chart on page 80 is useful in determining the return line size.

Actual load calculations are simple and in many instances unnecessary. One manufacturer of impulse steam traps has a selector catalog which shows directly the trap size for the particular process and capacity. It also incorporates a safety factor better identified as a "use factor."

The "use factors" range between 2 and 5 and are incorporated in calculations because of variables in known processes. For example, experience has shown that air cooled coils should use a factor of 5; submerged coils discharging by gravity use a factor of 2; submerged surfaces located below the steam trap should use a factor of 3.

Formulas designed to solve specific application problems are listed on pages 78-79.

Installation

Up to now emphasis has been placed on the selection of the proper size and type of steam trap for your application. Whatever work has been involved on your part, do not overlook an important "anti-climax"—installation.

Improper installation can make the best steam trap look poor. The following check list contains some seemingly obvious facts. Obvious or not, it is sur-

TABLE 6—FACTOR X USED TO FIND CONDENSATE LOAD

Trap Pressure, psig.	Temperature Rise of Substance Being Heated, deg F								
	40	60	80	100	120	140	160	180	200
	Factor X								
5	0.042	0.062	0.083	0.104	0.125	0.146	0.167	0.187	0.208
10	.042	.063	.084	.105	.126	.147	.168	.189	.211
15	.042	.064	.085	.106	.127	.148	.169	.191	.212
20	.043	.064	.085	.106	.128	.149	.170	.192	.213
25	.043	.064	.086	.107	.129	.150	.172	.193	.214
30	.043	.065	.086	.108	.129	.151	.172	.194	.215
35	.043	.065	.087	.108	.130	.152	.173	.195	.216
40	.044	.065	.087	.109	.130	.152	.174	.196	.218
50	.044	.066	.087	.110	.132	.154	.176	.198	.219
60	.044	.066	.088	.111	.133	.155	.177	.199	.221
75	.045	.067	.089	.112	.134	.156	.179	.201	.224
100	.045	.068	.091	.114	.136	.159	.182	.204	.227
125	.046	.069	.092	.115	.138	.162	.184	.207	.230
150	.047	.070	.093	.117	.140	.163	.187	.210	.234
175	.047	.071	.095	.118	.142	.165	.189	.213	.236
200	.048	.072	.096	.120	.144	.167	.191	.215	.239

prising how often the simple things are overlooked:

1. Blow down the line at full pressure before installing the steam trap.
2. Install a strainer ahead of the steam trap. A "Y" type strainer with a blowdown connection and fine mesh monel screen will do a good job.
3. Install a stop valve on each side of the steam trap so that normal necessary maintenance can be performed on the trap without shutting down the system. By using by-pass valves the system can remain fully operative on a temporary basis.
4. Install unions on threaded traps for quick removal.
5. Install traps with the flow in the proper direction. Look for a marking on the trap body.
6. The use of a tee connection and blowdown valve in the discharge line after the trap will aid in determining if the trap is operating properly.
7. Install steam traps where they are accessible. If possible, group the traps so that normal maintenance checks can be made quickly.
8. Install traps close to the equipment if possible. Steam traps requiring cooling legs are an exception.
9. Pitch the lines to the trap. This will keep water at the trap at all times and prevent steam binding. If pitching is not possible, consider the use of a water seal.
10. For outdoor installations use self-draining steam traps. If this type is not used, consider insulating the trap to reduce the risk of freezing.

TABLE 7—CONDENSATE FORMED BY RADIATION FROM BARE IRON AND STEEL SURFACES (UNITS: LB/SQ FT/HR*)

Air Temp, deg F	Steam Pressure, Psig																			
	1	2	5	10	15	20	25	50	75	100	150	200	250	300	350	400	450	500	600	
32	.53	.54	.57	.70	.74	.78	.81	1.02	1.13	1.30	1.46	1.70	1.86	1.97	2.31	2.41	2.52	2.62	3.14	
50	.48	.49	.52	.56	.68	.71	.74	.87	1.06	1.15	1.38	1.52	1.74	1.85	1.96	2.06	2.41	2.52	2.71	
60	.45	.46	.49	.53	.56	.59	.71	.84	1.02	1.10	1.34	1.47	1.58	1.80	1.91	2.00	2.35	2.46	2.65	
65	.44	.45	.47	.52	.55	.58	.69	.82	1.00	1.08	1.32	1.45	1.56	1.77	1.88	1.97	2.07	2.43	2.62	
70	.39	.40	.45	.50	.53	.56	.59	.80	0.98	1.06	1.21	1.43	1.54	1.75	1.86	1.95	2.04	2.39	2.59	
75	.38	.39	.44	.49	.52	.55	.58	.77	.88	1.05	1.19	1.40	1.52	1.62	1.83	1.93	2.02	2.11	2.56	
Value of heat loss used (H)		2.6			2.8			3.2		3.5			3.75			4.0			4.5	5.0

* Based on still air; for forced-air circulation multiply above values by 5

11. Return lines should be of ample size. Provide for future additions to the return line by keeping it large enough. If possible, consider the use of 45 degree lateral fittings where the condensate enters the return line. This may help keep back pressure to a minimum. Also consider pitching the return lines away from the steam traps.
12. If possible, keep steam traps below the equipment being drained. This provides a positive pressure, assuring complete drainage at shut down.
13. Where condensate is to be lifted to a return line higher than the steam trap, use a check valve in the discharge line from the trap. Select the proper type of check valve, one which opens easily and is recommended for steam trap service. Remember to add this lift into your back pressure calculations.
14. Trap each piece of equipment separately. If one trap is to drain several pieces of equipment, use a manifold with the equipment draining into one end. Locate the trap at the lowest part of the manifold opposite the points of entry from the equipment. When draining multiple coils drain each coil with a separate trap. Usually the first two coils in a multiple coil will require larger trap capacities than any of the remaining coils.
15. Never use a pipe smaller than the trap size between the trap and the equipment being drained. This causes a flow restriction and will penalize the trap capacity.
16. Avoid using traps in parallel to drain one piece of equipment.
17. Use a trap at each low point on steam mains. Maximum distance between traps should not exceed 500 ft.
18. Traps can be used at low points in steam headers, and ahead of pressure reducing valves and other regulatory equipment.

TABLE 8—STEAM CONDENSED BY AIR

Temperature Differential, Deg F	Pressure, psig				
	5	10	50	100	150
	Steam Condensed by Air, Lb per Hr. per 1000 cfm*				
50	61	61	63	66	67
100	120	122	126	132	134
150	180	183	189	198	201
200	240	244	252	264	268
250	300	305	315	330	335
300	360	366	378	396	402

*Based on 0.0192 Btu absorbed per cu ft of saturated air per deg F at 32 F. For 0 F, multiply by 1.1.

Maintaining a Steam Trap

No matter how much consideration you have given to the selection of your trap or how carefully it was installed, you must still take care of it and the associated equipment. Your heat transfer equipment must be shut down and cleaned periodically to maintain peak efficiency, so why not look after the trap, valve, check valves and strainer that are in the line. They get dirty too. A few simple periodic checks will perform wonders:

1. Clean and examine the steam trap for worn parts at least once a year.
2. Blow down strainers during normal operation. Excessive clogging reduces the pressure at the trap, hence capacity is reduced.
3. Consider the use of surface pyrometers, thermometer wells and pressure gages as a means of locating trouble at the steam trap.

Trouble-Shooting Steam Traps

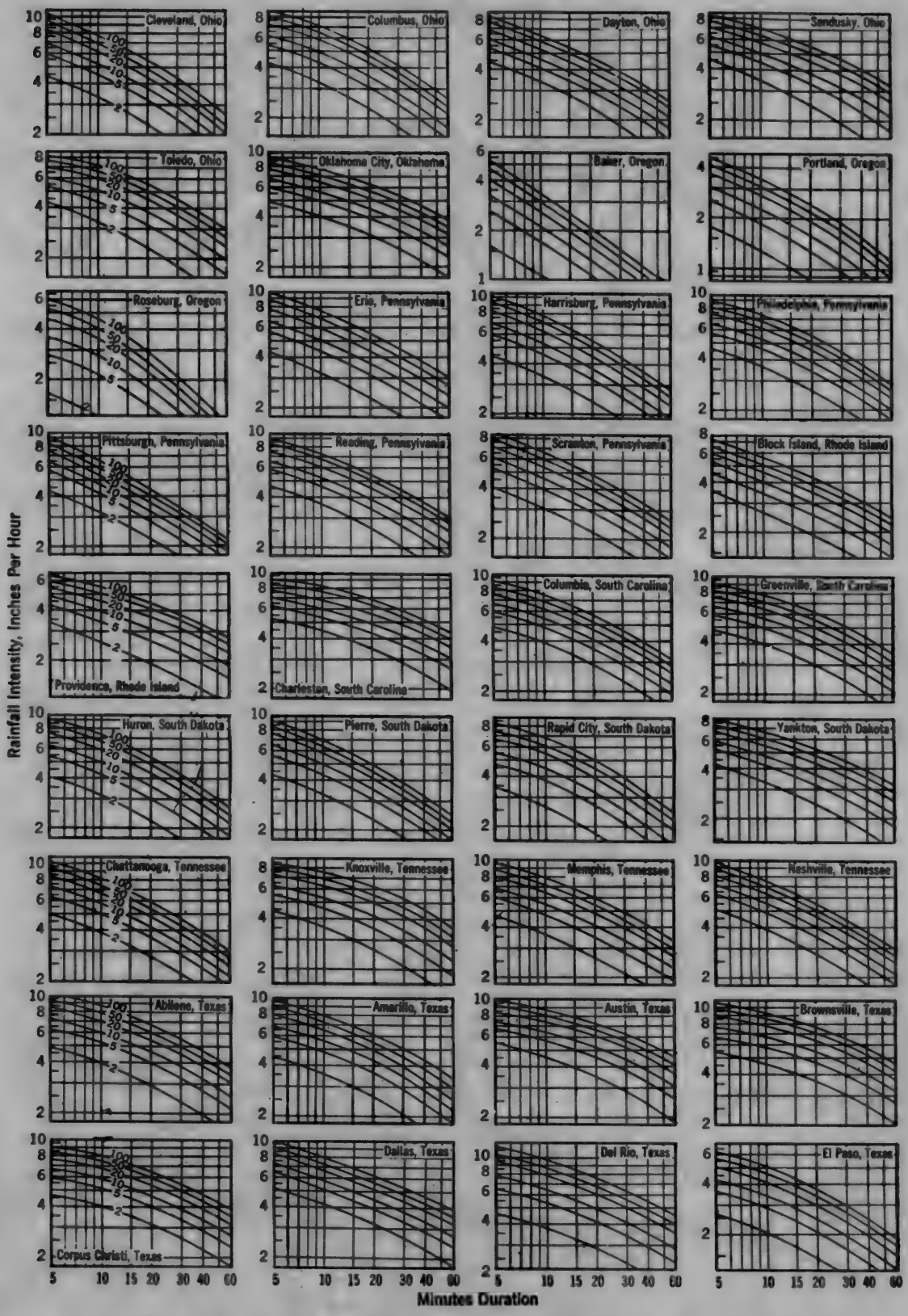
If your equipment is not maintaining temperature, or the steam trap does not seem to be performing properly, what should you do?

1. Check to make sure all stop valves are open.
2. Use your pyrometer, thermometer or pressure gage to determine conditions at the trap.
3. If possible blow down strainer to be sure trap is under positive pressure.
4. Observe trap discharge. Continuous discharge of condensate indicates that flow through the trap is restricted—possibly the trap is too small or partially clogged. If no discharge is observed, the piping or the trap itself may be clogged—perhaps broken or otherwise defective.
5. In the case of no discharge from a bucket trap, pressure may be too high or the vent hole plugged. If you are using an impulse trap, the orifice may be clogged.
6. Continuous but restricted discharge indicates a "throttling" action. The trap is not opening fully, due to an obstruction within the trap. Usually under these conditions the discharge is steam (not flash steam). Closing the inlet valve to a bucket trap will help re-establish prime in the event of steam binding. A steam leak is also indicated if inlet and outlet temperature are very close.

From the standpoint of initial investment, a steam trap represents a small sum compared to other pieces of equipment. When this relatively inexpensive piece of equipment is improperly applied, installed or maintained, an expensive piece of heat exchange equipment ceases to work efficiently. Therefore, time initially spent on the steam trap selection can save many hours and dollars in the future.

RAINFALL INTENSITY-DURATION-FREQUENCY CURVES

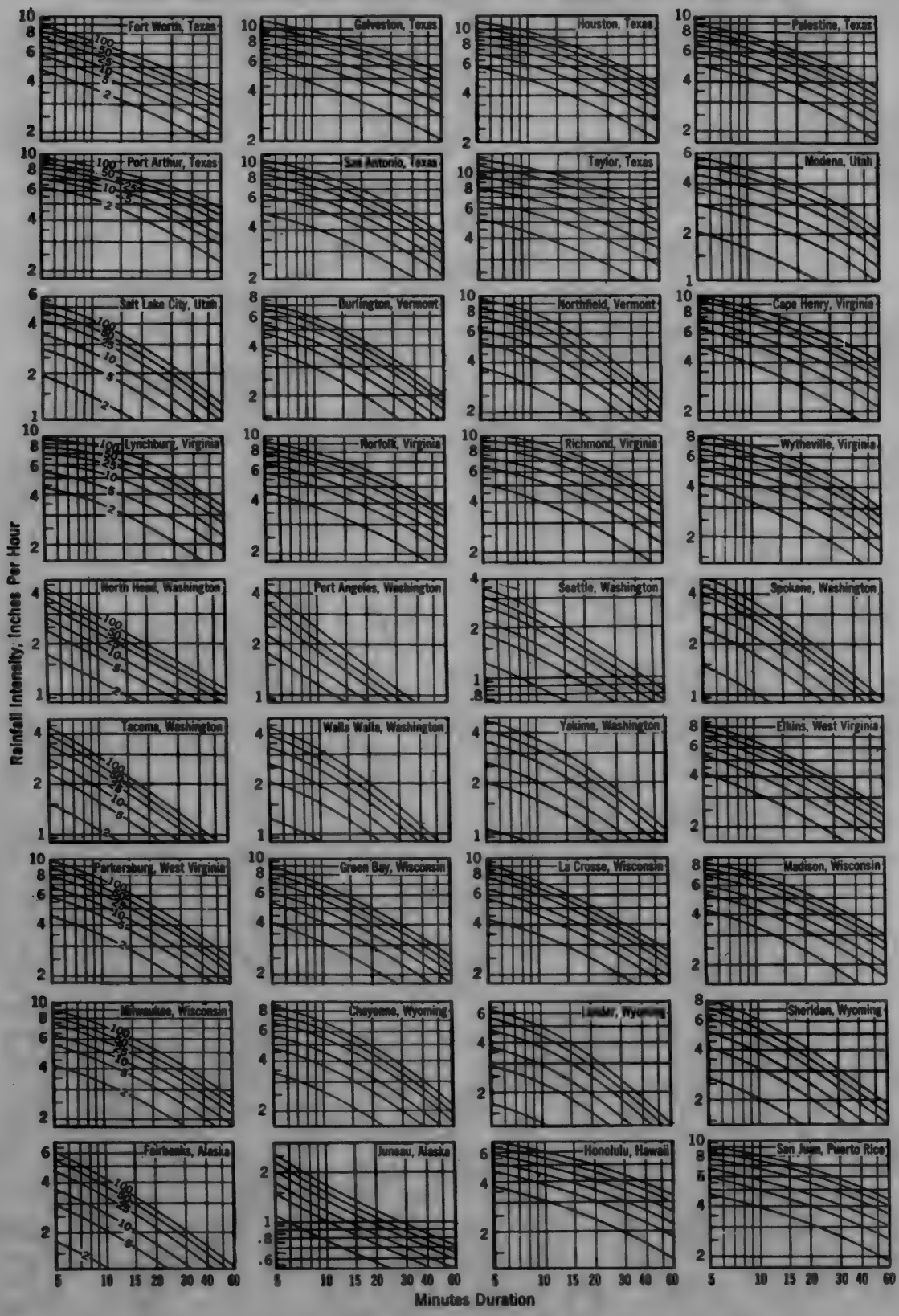
(Concluded from last month)



REFERENCE DATA—AIR CONDITIONING, HEATING AND VENTILATING

August, 1961

RAINFALL INTENSITY-DURATION-FREQUENCY CURVES



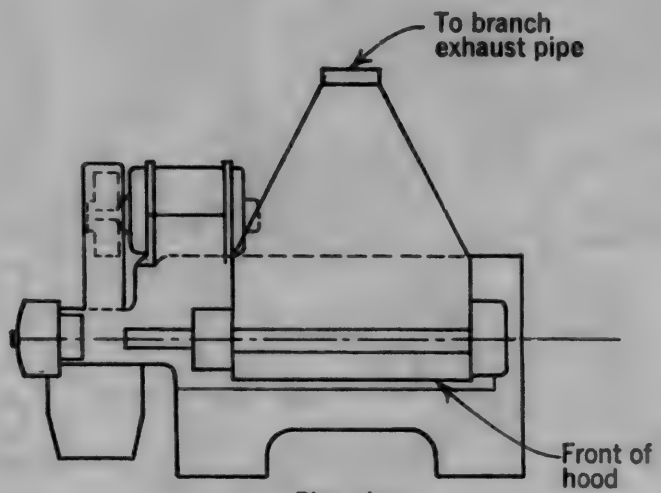
(The series is concluded)

REFERENCE DATA—AIR CONDITIONING, HEATING AND VENTILATING

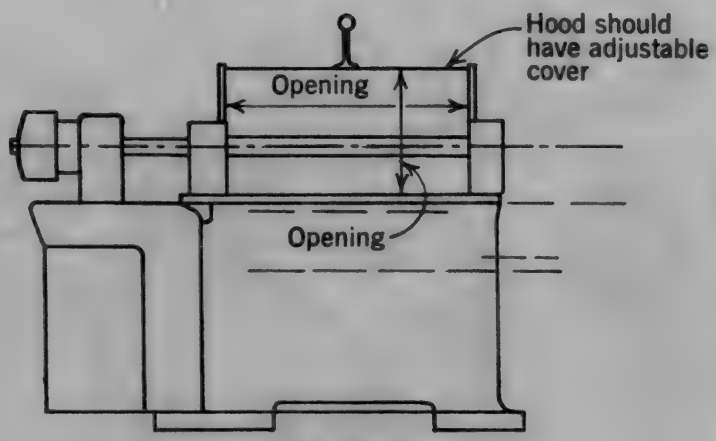
August, 1961

EXHAUST HOODS FOR WOODWORKING EQUIPMENT

Design for an Automatic Lathe



Plan view

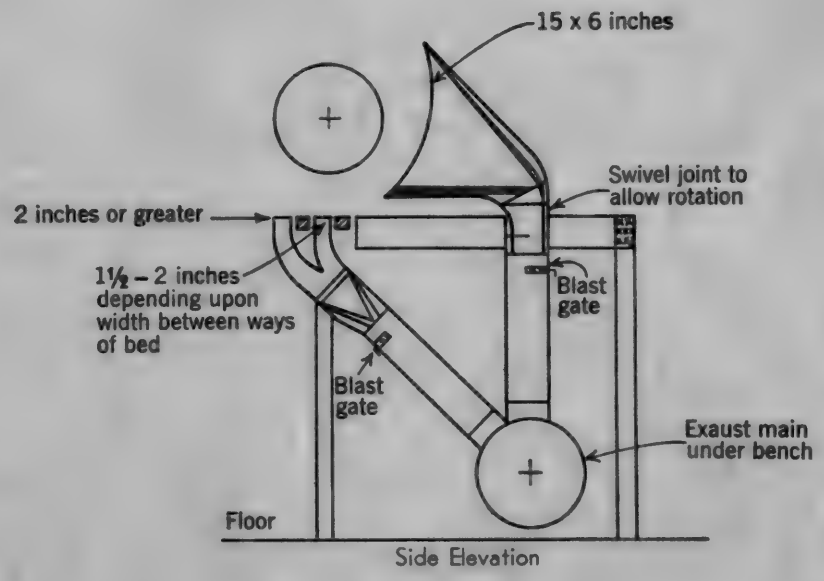


Front elevation

Exhaust hood for an automatic lathe encloses work at the side as well as top and bottom. A taper at the rear leads to the branch exhaust pipe. Extremely high velocities are needed through the face openings of this type of hood; five-hundred feet per minute would not be excessive. It should be borne in mind that this hood will be effective only if the work is carried on well within the enclosure. The hood also acts as a cutter knife guard.

EXHAUST HOODS FOR WOODWORKING EQUIPMENT

Design for a Manually-Operated Lathe


15 x 6 inches
Swivel joint to allow rotation
2 inches or greater
1½ – 2 inches depending upon width between ways of bed
Blast gate
Blast gate
Exaust main under bench
Floor
Side Elevation

For manually-operated lathes, a hood designed on the basis of the above drawing can be used to good advantage. Depending on the work, the complete hood, as shown, or either of the two components may be practical. However, if only one section is used, the air flow rates for this section should be increased. The rear hood should be designed with some degree of flexibility to permit rotation of the hood. It should be installed near the face plate.

Downdraft hood dimensions will vary according to the lathe itself. The openings between the ways and in the front should be as wide as practical. Face velocities through the openings should be around 1000 LFM for the rear hood and 2000 LFM for the downdraft hood. Length of these hoods will depend upon length of lathe bed; however, from a practical consideration it may be advisable to restrict the length to 12 to 15 inches near the face plate since most lathes are operated in this area.

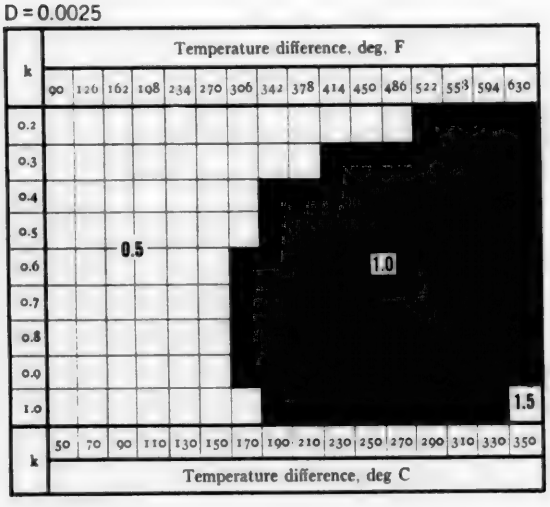
According to Martin Slotkin, Engineering Section, Division of Industrial Hygiene, New York State Department of Labor, who furnished this information as a public service, no hood for this type of equipment can be completely effective, and frequent, careful sweeping of chips and dust is necessary to maintain good housekeeping.

How Much INSULATION for Pipes and Flat Surfaces?

Herein is continued Table 2 for determining economic thickness of pipe insulation. The table was begun in the May Reference Section and continued last month for the 2-inch pipe size. Data are from "Manual on Economic Thickness of Insulation for Flat Surfaces and Pipes", developed by West Virginia University and Union Carbide Chemicals Company. Only those portions of the Manual most useful to ACH&V readers have been reproduced. The whole Manual is available in an edition published by National Insulation Manufacturers Association, 441 Lexington Ave., New York 17, N. Y., at $8 per copy.

Table 2. Economic Thickness. 2½" Pipe
(D from Fig 1; k from Fig. 2; read thickness in inches.)

D = 0.0025



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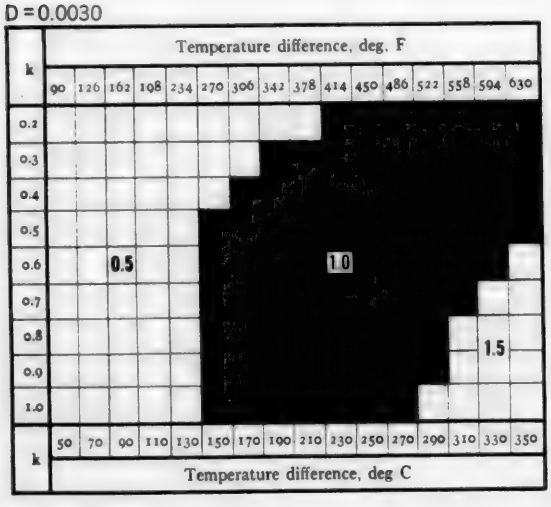
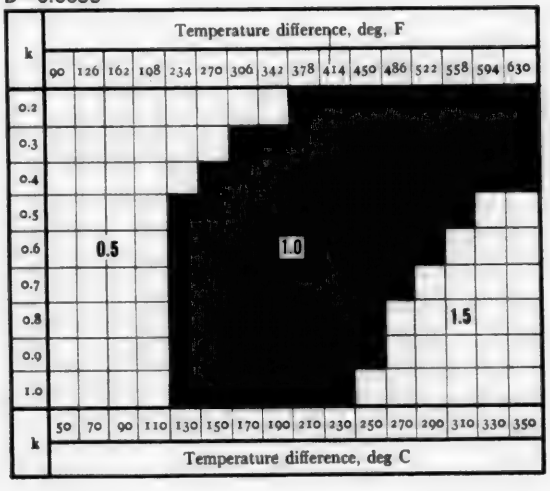


Table 2. Economic Thickness. 2½" Pipe
(D from Fig 1; k from Fig. 2; read thickness in inches.)

D = 0.0035



D = 0.0040

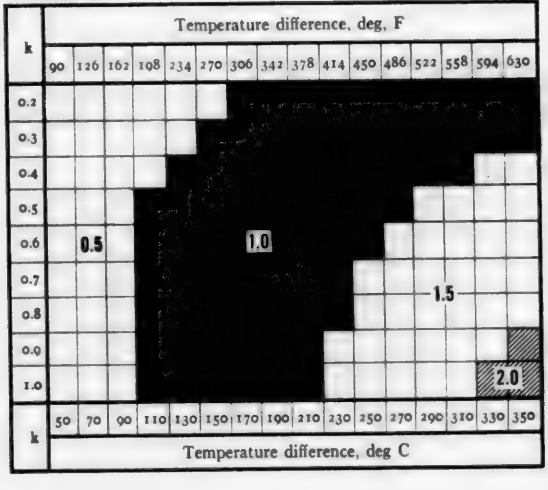
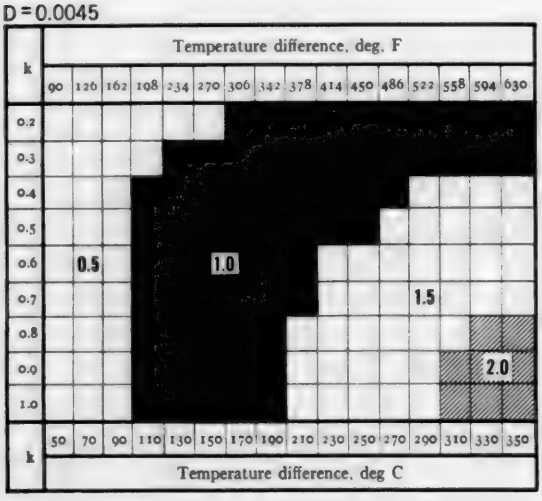
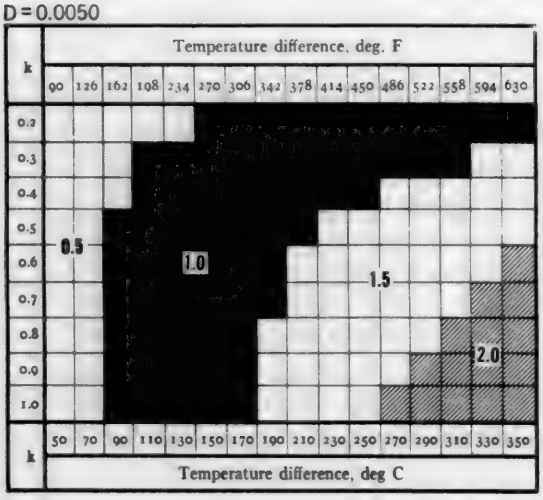


Table 2. Economic Thickness. 2½" Pipe
(D from Fig 1; k from Fig. 2; read thickness in inches.)

D = 0.0045



D = 0.0050



D = 0.0060

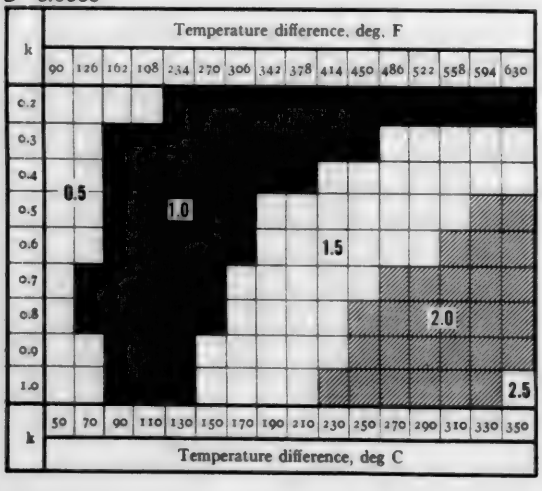
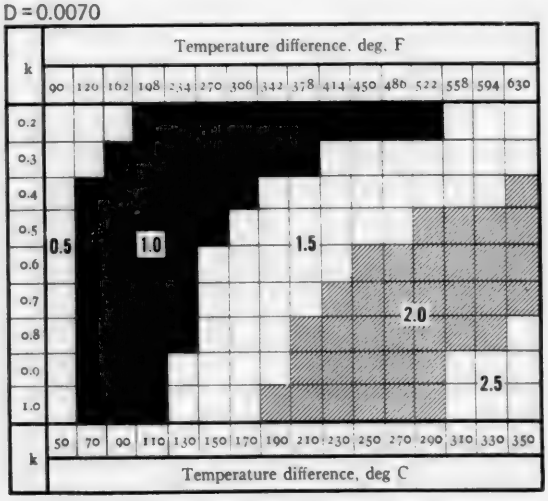
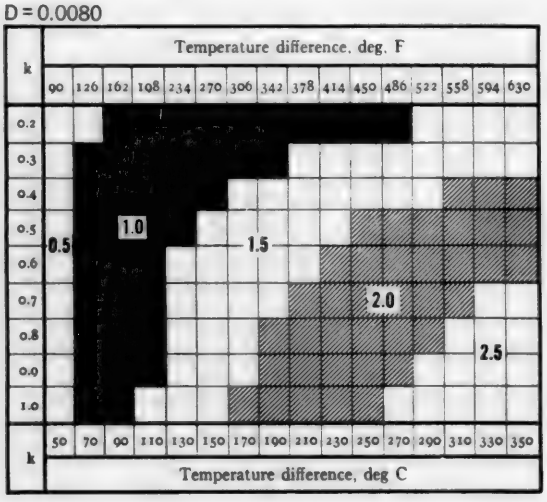


Table 2. Economic Thickness. 2½" Pipe
(D from Fig 1; k from Fig. 2; read thickness in inches.)

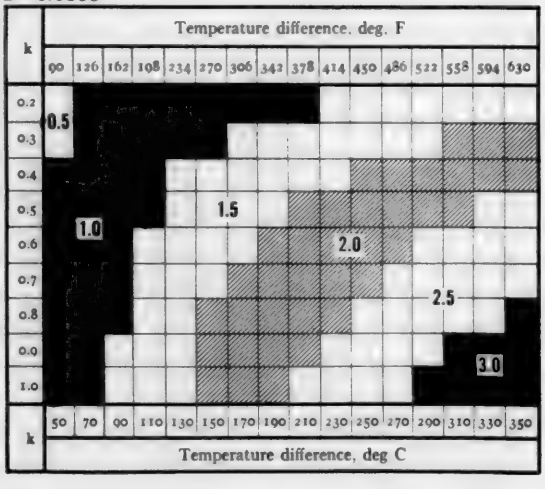
D = 0.0070



D = 0.0080



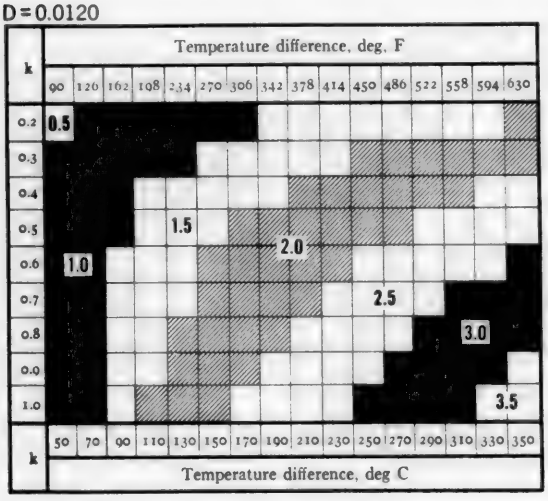
D = 0.0100



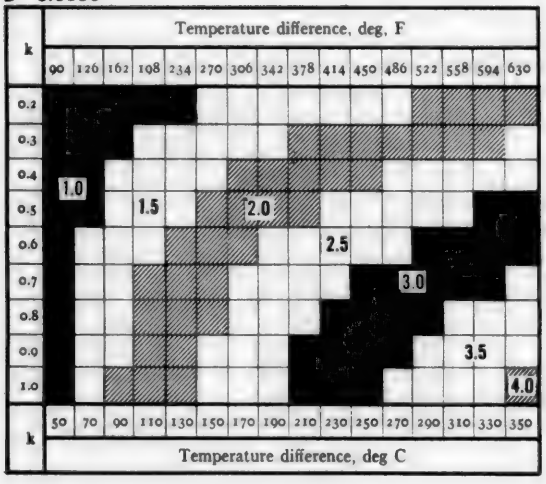
developed at West Virginia University with Union Carbide Chemicals Company.

Table 2. Economic Thickness. 2½" Pipe
(D from Fig 1; k from Fig. 2; read thickness in inches.)

D = 0.0120



D = 0.0150



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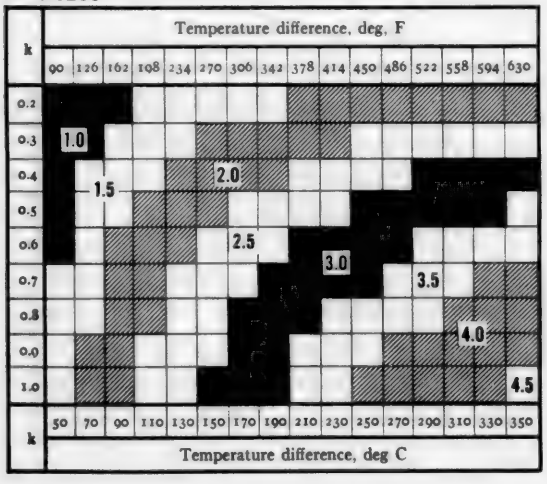

Table 2. Economic Thickness. 2½" Pipe
(D from Fig 1; k from Fig. 2; read thickness in inches.)

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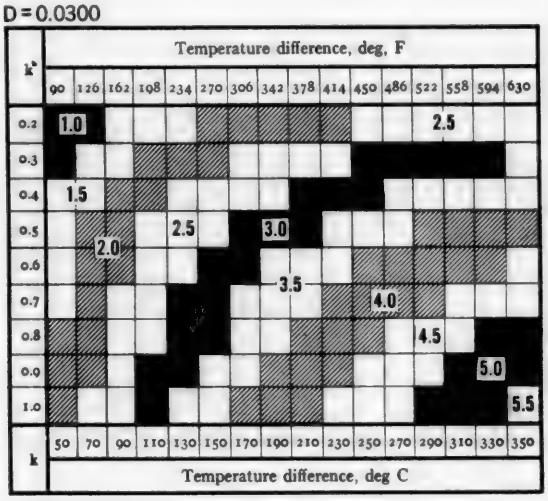
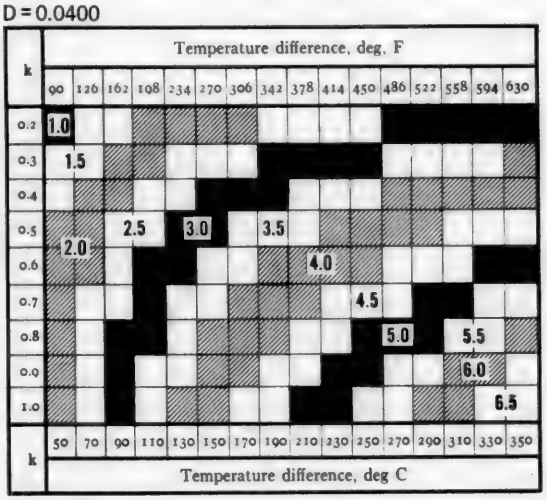


D = 0.0400



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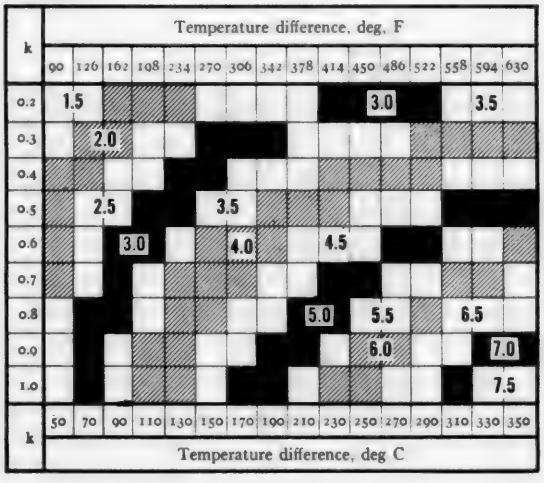
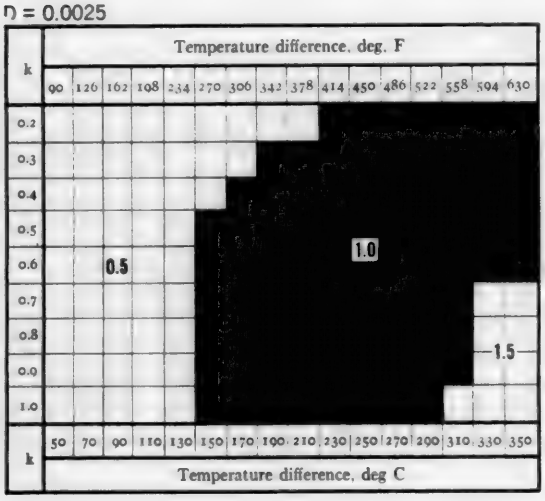


Table 2. Economic Thickness. 3" Pipe
(D from Fig 1; k from Fig. 2; read thickness in inches.)

D = 0.0025



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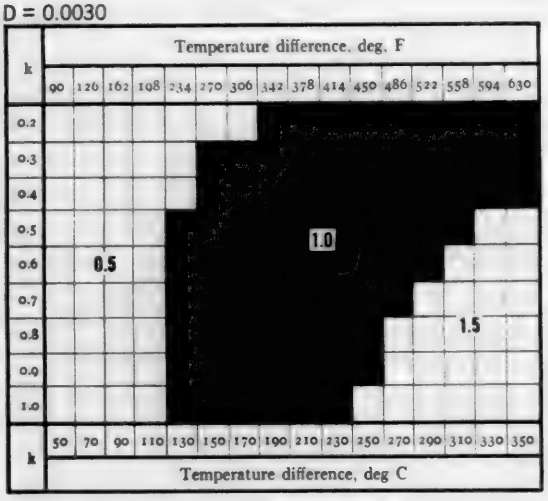

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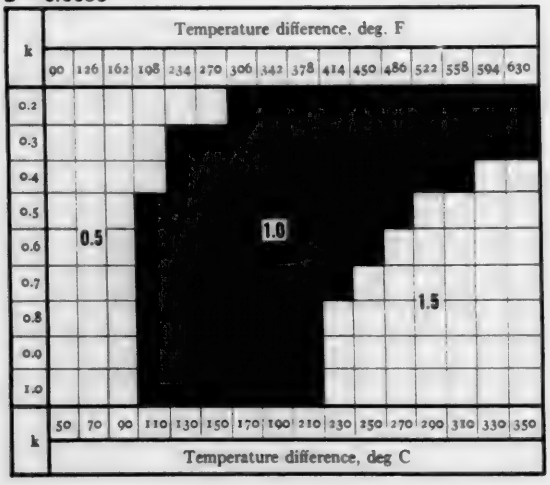

Table 2. Economic Thickness. 3" Pipe
(D from Fig 1; k from Fig. 2; read thickness in inches.)

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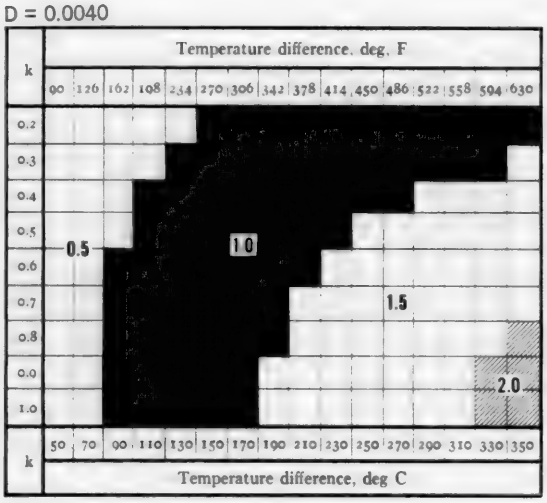

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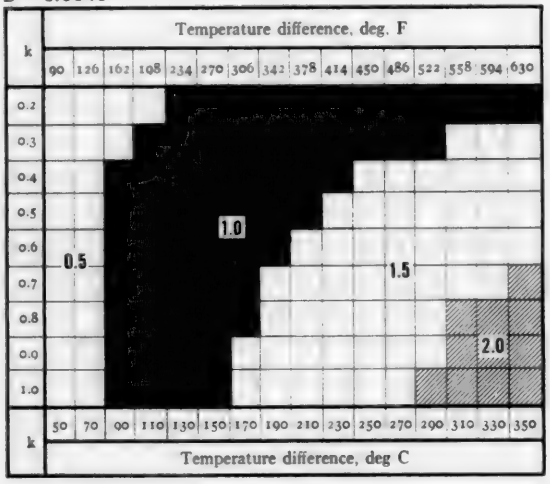

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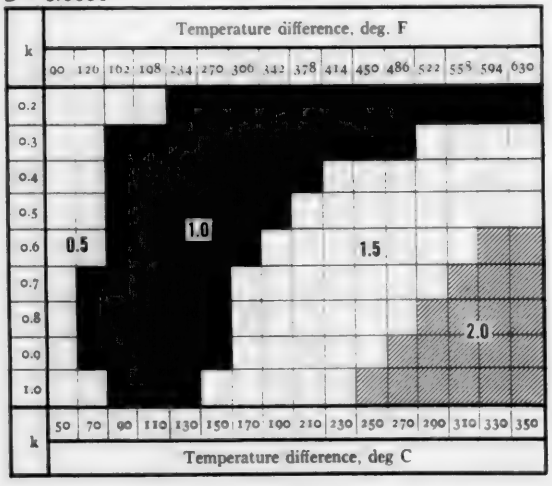

of the May, 1961 issue, which includes full instructions on use of these data.

Table 2. Economic Thickness. 3" Pipe
(D from Fig 1; k from Fig. 2; read thickness in inches.)

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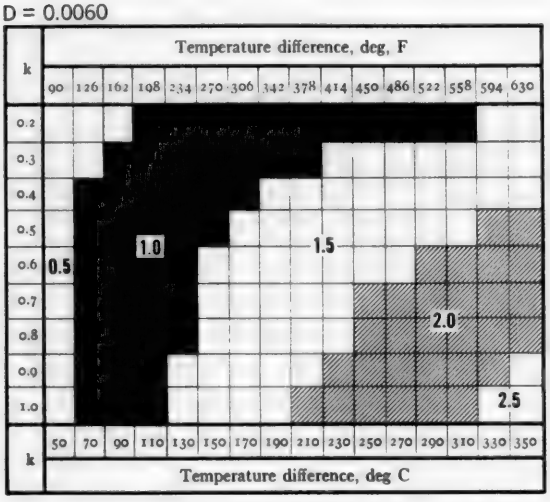

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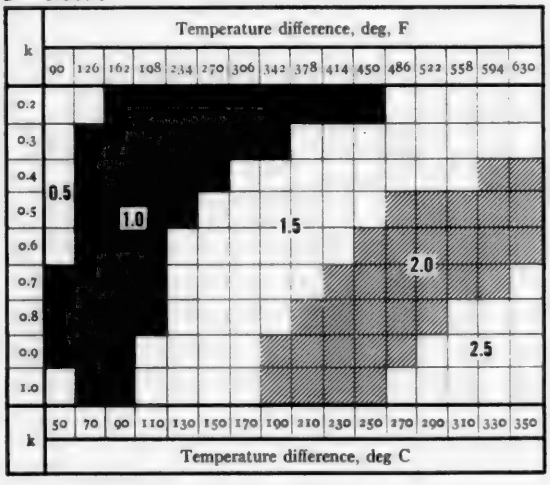

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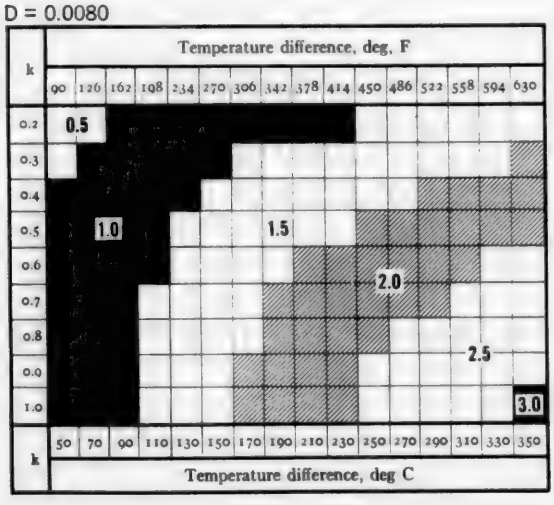

Table 2. Economic Thickness. 3" Pipe
(D from Fig 1; k from Fig. 2; read thickness in inches.)

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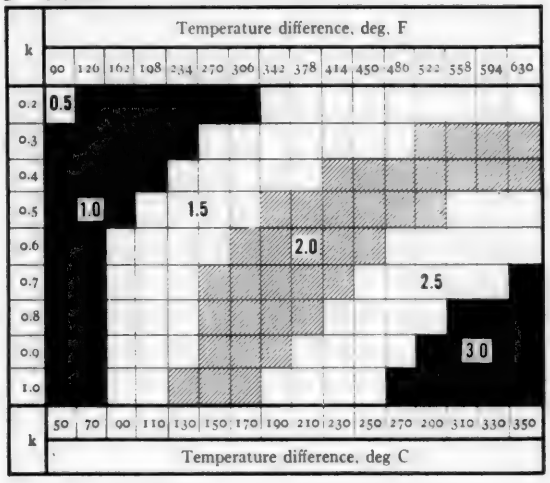
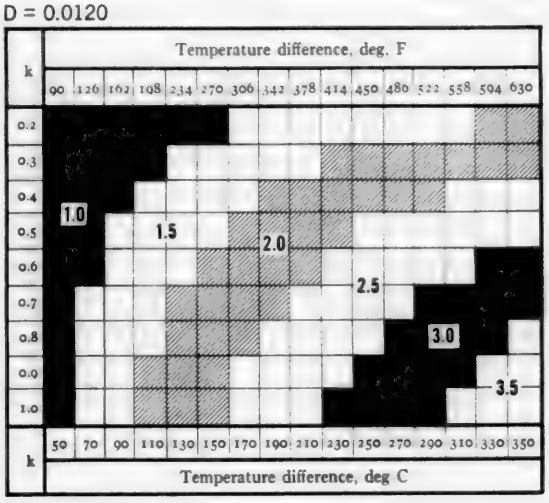


D = 0.0120



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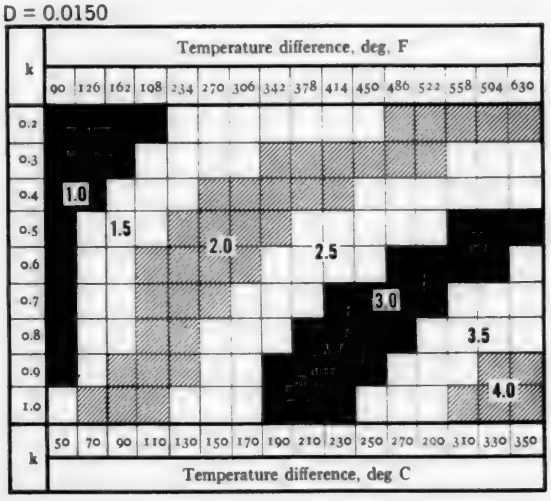

Table 2. Economic Thickness. 3" Pipe
(D from Fig 1; k from Fig. 2; read thickness in inches.)

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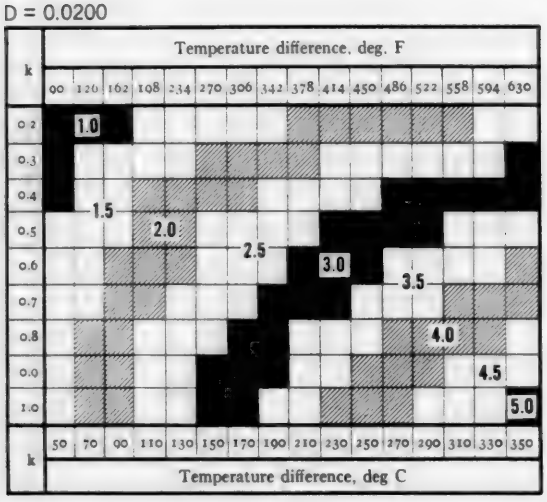

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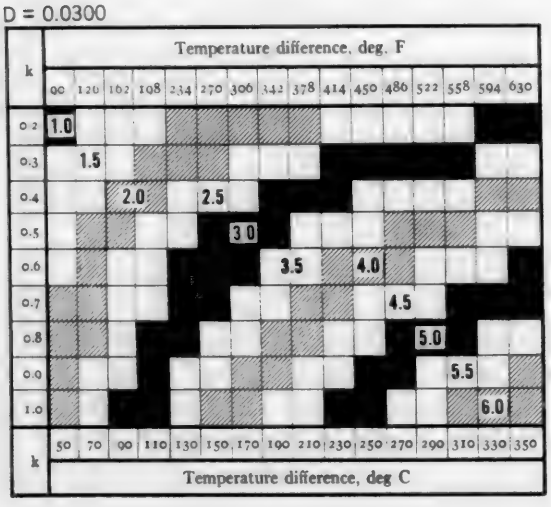

Table 2. Economic Thickness. 3" Pipe
(D from Fig 1; k from Fig. 2; read thickness in inches.)

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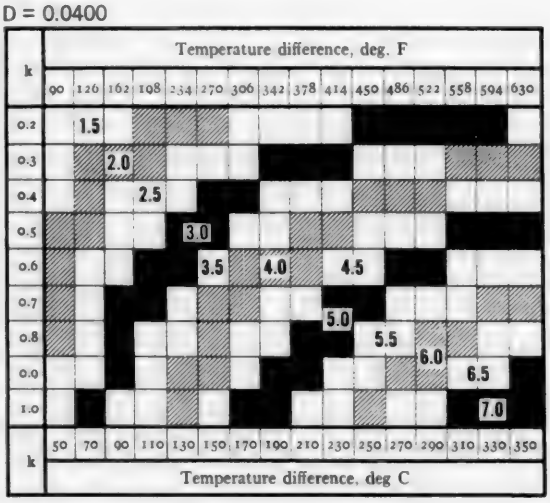

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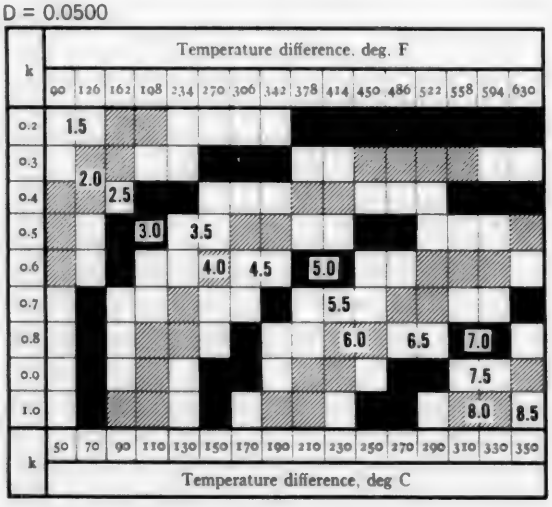


(The series is concluded in next month's issue.)

Piping Gimmicks that Don't Work

Upon examination, some common refrigerant piping arrangements are seen to be, at best, useless; sometimes, actually harmful.

REFRIGERANT PIPING is like anything else. If the designer, without understanding what he is doing, merely follows what someone else has done before, he is likely to be led, like the proverbial sheep, to the slaughter. In the following paragraphs, we will review some common, but useless piping gimmicks, show some of the fallacious reasonings used to justify them, and suggest some worthwhile substitutes.

High Loop in Suction Line

Something like the diagram, Fig. 1, will be found in a number of refrigerant piping manuals. Accompanying the diagram is found some statement like "If the compressor is below the evaporator outlet, the suction line should rise above the top of the evaporator to prevent liquid refrigerant from draining into the compressor during shutdown."

The inventor of this gimmick probably was under the mistaken impression that the liquid level in the rising suction line is the same as the liquid level in the evaporator! This could be true only if the pressure at the high point of the suction line were precisely the same as the pressure in the evaporator. This is equivalent to expecting that a level gage on a boiler, connected only below the water level, with its upper connection left open to the atmosphere, or connected to some point other than the steam space, would indicate the level in the boiler.

What is the actual situation? Imagine that an R-22 compressor has stopped and that its temperature at that moment is 70 deg F and the temperature of the evaporator is 40 deg F. Any refrigerant liquid at the compressor will immediately gassify if the pressure at the compressor is any less than 137 psia, the saturation pressure corresponding to 70-deg. The evaporator, containing both liquid and gas, is at the saturation pressure of 84 psia, corresponding to 40 deg. Because the pressure in the compressor is greater than that in the evaporator, liquid cannot drain to the compressor provided there is a small trap in the line. (Of course, if there were no trap, it would be possible for the gas to flow from the compressor while liquid is flowing in the same pipe, from the evaporator, in the opposite direction.) However, a high loop would be of no more value than a very shallow trap.

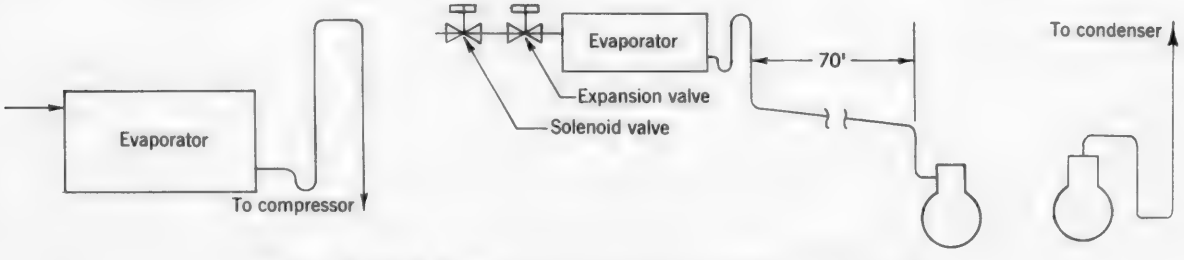
Now suppose that the evaporator temperature, during shutdown, rises to 75 deg, so that there is pressure forcing the liquid from the evaporator to the compressor. How high a loop would be necessary to prevent the draining?

The corresponding evaporator pressure of 148 psia is 11 psi greater than the pressure at the compressor. The equivalent liquid column would be 21 ft. Thus, the loop would have to rise 21 ft above the liquid level in the evaporator (not the top of the evaporator). Furthermore, this 21-ft rise, which is certainly impractical, is to handle the difference of only 5 deg between the compressor and the evaporator.

The scheme outlined in Fig. 1 may be worse than useless. Any large loop will accumulate liquid, which, when the compressor starts up, will return to the compressor as a massive slug. Furthermore, a very high loop is still no guarantee that the liquid will not get down to the compressor. During a prolonged shutdown the loop may be warmer than the compressor. Refrigerant liquid, trapped in it, will boil away and condense in the cooler compressor. Insulation may slow, but not prevent it.

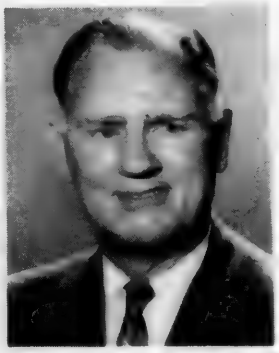
Long Suction Line

Figure 2 illustrates the case of a long, uninsulated suction line that runs through a cool space, pitching down to the compressor. An actual installation, similar to this, incorporated a 250-watt crankcase heater. Refrigerant liquid in the compressor was partly evaporated and partly pushed, due to the pressure of the



Figs. 1, 2, and 3: Refrigerant piping hookups NOT recommended.

ABOUT THE AUTHOR



Melvin A. Ramsey is no stranger to readers of Air Conditioning, Heating and Ventilating, who know him through the pages of the magazine, heard him at numerous meetings of technical societies, and met him on the job, where, as consulting engineer for Air Conditioning and Refrigeration Division of Worthington Corporation, he has contributed his considerable experience to the solution of many difficult design and installation problems.

In each monthly installment, Mr. Ramsey, a licensed professional engineer in New York and New Jersey, selects for discussion some aspect of air conditioning and refrigeration design which he finds is giving engineers trouble. In so doing, he draws from experience that dates back to 1927, when he was a designer and estimator for Baker, Smith & Company of New York City.

Inquiries for more information about the topics already covered, or for technical information on other topics in his field, addressed to the Editor, will be happily passed on to the author, who, as visiting instructor at Newark College of Engineering and Stevens Institute of Technology, thrives on them.

evaporating liquid, into the suction line, thereupon it drained right back into the compressor. As fast as the heater evaporated, the suction line condensed the liquid, so that eventually all the liquid was returned. The situation is akin to that of a one-pipe steam heating system. To keep the compressor crankcase free of liquid, it would be necessary to have a heater of sufficient capacity to keep the entire suction line warmer than the evaporator. In fact, a 1000-watt heater was installed, and it was found insufficient.

A small trap, installed at the point where the suction line drops to the compressor, would make it possible for the heater to keep the refrigerant out of the compressor during shutdown. A slight pitch up to the compressor, instead of down, would have the same effect. However, the instant the compressor started up it would get the large quantity of liquid which had collected in the suction line, with almost certain disastrous results.

The solution to this problem is continuous pumpdown, an adequate knockout drum, and preferably both. Continuous pumpdown takes care of the start-up problem but, variable capacity operation still leaves the probability of liquid carryover during operation. Therefore, the knockout drum serves to protect the compressor against this or any other failure which might cause liquid carryover.

Discharge Line to the Roof

It is common practice to trap a discharge line before it rises to an evaporative or air-cooled condenser on a roof. This arrangement may have some value in preventing oil, which drains back from the vertical line, from going back to the compressor. Unfortunately, some think the trap will also keep refrigerant liquid from getting to the compressor. A sun-drenched condenser with receiver can easily reach 120 deg, while a compressor, even one equipped with a crankcase heater, will probably not exceed 95 deg. Given R-22, the potential pressure differential would be 78 psi, which is equivalent to 150 feet of liquid column! In practice, of course, this pressure differential would not exist because of the pipe which connects the two points. What will happen is that the liquid in the receiver will boil away, the gas will move down toward the compressor, condensing either in the discharge line or the compressor itself. It can easily be seen how useless a trap, like that illustrated in Fig. 3, would be in keeping liquid from the compressor.

A better way of solving this problem is to place a discharge check valve at the condenser. As long as it remains tightly closed, the liquid will stay in the receiver.

Loop in Line to Evaporator

Another useless loop, sometimes specified, is shown in Fig. 4. Its proponents believe that, in the absence of a liquid line solenoid, and where the evaporator is at a lower level than the condenser or receiver, the 6-ft loop will keep liquid from draining into the evaporator when the compressor is idle.

To understand what actually happens in these cases imagine that an R-22 compressor has just shut down. The liquid line is probably full. If the liquid is sufficiently subcooled, the loop becomes merely a siphon, the weight of the down-moving leg lifting the up-going leg, the loop having no value at all. But, for the liquid from the receiver to remain a liquid when rising 6 ft in the short leg, it must have been subcooled the equivalent of 6 ft of liquid column prior to entering the loop. This would be approximately 3 psi below the actual pressure upon it. Two degrees of subcooling, resulting in an 88-deg liquid, would result in a 5-psi differential. This degree of subcooling is usual when liquid leaves a condenser, but if the liquid is leaving a receiver into and out of which the liquid runs, the likelihood is that there may not be even one degree of subcooling. In that case, the siphon will break.

Assume that there is practically no subcooling and assume further the unlikely case that, when the compressor stops, the temperature of the evaporator is high enough, relative to that of the condenser, to force the liquid up the liquid line into the receiver against the static head of the liquid line. Then, no control of liquid flow would be required.

Control of liquid flow from condenser to evaporator is required if, when the compressor is idle, the temperature of the condenser or receiver is higher than that of the evaporator. This is a rather likely condition. The higher pressure in the receiver or condenser tends to empty out the receiver and results in flow to the evaporator. However, the most that a 6-ft column of liquid could do would be to impose a 3-psi pressure barrier. But if we assume that the evaporator is at

75 deg, and that the condenser is at 77 deg, the mere 2-deg differential temperature results in a pressure differential of 4.5 psi!

The best way to assure that there is no flow of liquid from a receiver to an evaporator during shutdown is to use a solenoid valve in the liquid line.

A Better Receiver Hookup

When the condenser volume is not sufficient for pumpdown of the full refrigerant charge, a receiver is usually used. Most of us, myself included, have connected these receivers so that liquid runs *through* them. Some have been connected as a surge chamber or expansion tank as shown in Fig. 5.

Defects of the arrangement wherein liquid goes *through* the receiver include:

1. An extra quantity of refrigerant is required to provide sufficient level above the receiver outlet to enable liquid to leave without gas leaving with it. This situation is most critical when the receiver has a dip tube for a liquid outlet, unless the tube dips into a pot. (In the case of ammonia, the dip tube is intended for additional oil separation and may have some value for that reason. With refrigerants miscible with oil, this has no value.)

2. Sending refrigerant through the receiver reduces, and in most cases practically loses, any degree of subcooling. Liquid from a condenser is always subcooled to some extent, usually at least 5 deg. This helps to make it possible to get a clear liquid sight glass and avoid objectionable flash when the liquid line rises a few feet. At 90 deg condensing with R-22, 5-deg subcooling allows a 24 ft rise plus a 2-psi friction loss before flashing occurs.

The method of receiver connection shown in Fig. 5 loses none of the subcooling. Connections to the receiver are small. The liquid line from the condenser should be sized the same way as any liquid line; on the basis of pressure loss or limiting velocity to avoid excessive pressures due to rapid closing of a liquid line valve. Pressure loss between condenser and receiver connection has an effect on the level difference between condenser outlet and the bottom of the receiver. This is discussed later. There is no reason to make the line larger between condenser and receiver to permit gas to vent back to the condenser while liquid flows to the receiver through the same pipe. The liquid in the line from the condenser, in this case, is going to the system, not to the receiver. The

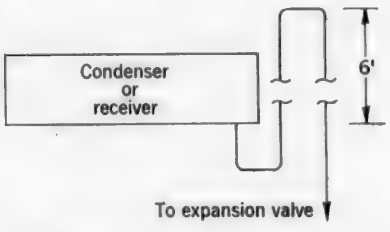


Fig. 4. Another useless loop.

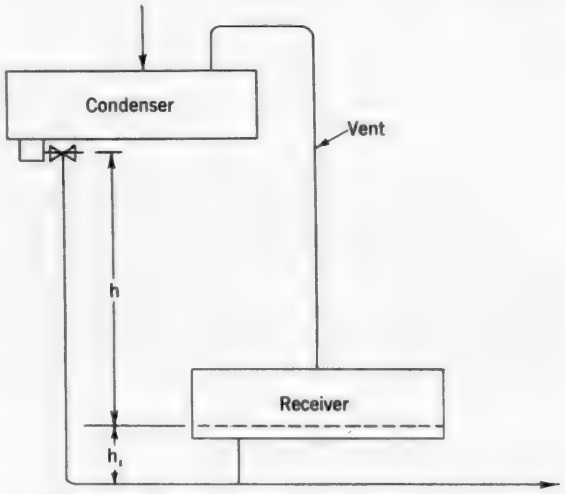


Fig. 5. This receiver hookup has advantages. •

liquid connection into the receiver will probably be the same size at the liquid line. It might even be a little smaller, definitely not larger.

Vent size is determined by permissible pressure drop. Gas in it may flow either way, depending on whether the receiver ambient is at a higher temperature than the condensing temperature or *vice versa.* Flow rate depends on the rate of heat transfer from and to the receiver which will result in condensing or evaporating liquid. This, in turn, depends on the greatest difference in temperature between receiver ambient temperature and condensing temperature, the receiver surface, and air velocity over it, which affects heat transfer. If, after installation, the operation indicates an undersized vent, wrapping the receiver with insulation will improve operation.

Height h in Fig. 5 must be sufficient to provide a liquid column equivalent to maximum pressure losses from (*a*) inlet of the condenser through the liquid line to the receiver connection, plus (*b*) the largest vent line loss when the receiver ambient temperature is *greater* than the condensing temperature. The pressure loss through a shell and tube condenser is very small, but for air-cooled or evaporative condensers it is likely to be as much as 2-7 psi, requiring h to be about 15 ft. When the evaporative condenser is on the roof and the compressor is located a floor or two below, there is no problem, but there are many cases where this method of connection cannot be applied due to space limitations.

The value of h_1 must be sufficient to provide a liquid column equivalent to (*a*) the largest vent line loss when the receiver ambient temperature is *less* than the condensing temperature minus (*b*) the minimum pressure loss from the inlet of the condenser through the liquid line to the receiver connection. This latter pressure loss is very small when and if the system operates at nearly zero capacity. Therefore my practice is to assume it zero.

Radiant Ceiling Panels Supplement Air Systems In New Airport Terminal Buildings

TAK KANAZAWA

Mechanical Project Engineer
Naess & Murphy, Architect-Engineers
Chicago, Ill.

NEW CHICAGO-O'HARE INTERNATIONAL AIRPORT is designed to provide the nation's second largest city with greatly expanded airport facilities which will accommodate the new commercial jet airliners and the expanded volumes of passengers, 10,000,000 per year, which they are expected to carry.

Airport Facilities

The airport passenger facilities will consist of two terminal buildings, each 140 ft wide and 780 ft long, four passenger concourses extending 900 ft from the terminal buildings, and a 200 ft dia circular restaurant building.

Four sides of the terminal building will be huge expanses of heat absorbing glass, supported by aluminum mullions and extending 24 ft high above the main floor. The first floor will be baggage handling areas and concessions. The second floor will have airline ticket counters, offices, waiting areas and general concession areas. The mezzanine floor above the 2nd floor is reserved for airline and airport administration offices.

Extending from these two terminal buildings will be four concourses. The concourses will include passenger departure rooms, airline offices, concession areas, and 20 ft wide corridors connecting different areas. Most of these passenger departure rooms will have all-glass walls on three sides. Most gate positions will have motorized bridges between a passenger departure room and a plane to load or unload passengers, and thus will eliminate exposing passenger to severe weather.

All areas except baggage handiing areas, mechanical rooms and storage areas will be air conditioned.

Multi-Zone Air Supply and Radiant Ceiling Panels

After considering the many and varied systems available a combination of low pressure multi-zone air systems and radiant ceiling panels has been chosen. Architectural esthetic requirements called for no heating element at sill elevation, despite large glass walls. After study, radiant ceiling panels for both hot water and chilled water circulation were determined capable of being tailored to meet design demands.

A manufacturer of radiant panels was called in for consultation, a test mock-up of a typical exterior bay

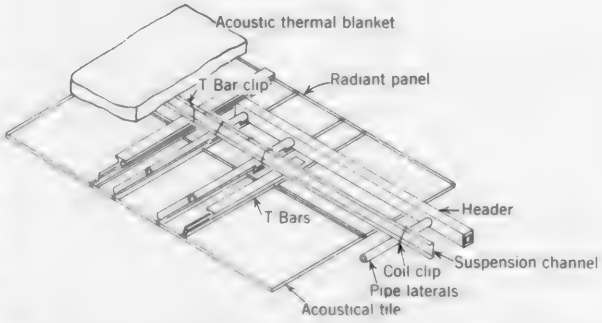


Fig. 1. Construction details of a typical radiant panel ceiling installation.

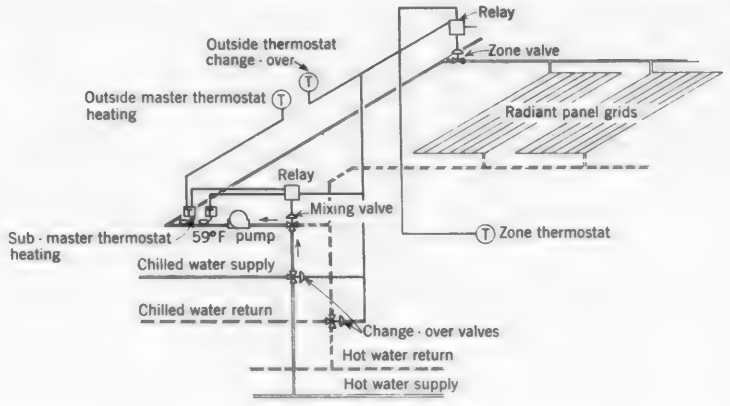


Fig. 2. Schematic diagram of a typical intermediate radiant panel control system.

of the terminal building was constructed. The tests were made by the manufacturer to determine the heating effectiveness of radiant panels placed over high glass. From these tests, it was found that narrow intensified radiant panels having capacity of about 50% of total heat loss at perimeter, plus less intense radiant panels for remainder of heat loss, would maintain comfortable conditions at the occupant's level. The advantage of hot water ceiling panels is that they could be used for sensible cooling of rooms by circulating chilled water during cooling season, thus reducing supply air quantities for cooling. Under our design conditions, the saving of supply air amounted to 0.9 cfm for each one square foot of radiant panels.

The radiant panel ceiling consists of water piping, aluminum panels and perforated metal pans which form the finished ceiling. Radiant panels can be layed out according to design load, and gaps between panels are filled with standard perforated metal pans to complete the ceiling. Figure 1 shows schematic view of a typical radiant panel installation. Lateral pipes are ½-inch galvanized schedule 40 steel pipes spaced 6 inches apart above radiant panels. One-by-two ft aluminum panels clip to lateral pipes. The lateral pipes are welded to supply and return headers. Close contacts between laterals and the panels permit heat from laterals to flow efficiently by conduction into the radiant ceiling surface. Little time lag is expected for the system response as the heat transfer from steel pipes to aluminum panels is relatively high.

Continuous glass fiber blankets placed above the pipe laterals are useful to prevent back radiation losses; also, the portion of blankets above perforated pans increase the acoustic absorption.

Application Panels

In each terminal building radiant ceiling panels are designed for 3 separate bands. An 8-ft band of radiant panels at perimeter of the building provides a concentration of radiation equivalent to 50% of total building heat loss. Inward from the 8-ft band, an 18-ft band of intermediate panels, consisting of alternate rows of perforated metal pans and radiant panels, have capacity equal to the balance of the building heat loss. The perimeter and the intermediate panels are also used for cooling during the cooling season. Remaining interior ceiling panels are designed for cooling only.

Operation of Panels

During heating season, the perimeter panels will be controlled by an outside master thermostat. Another outside master thermostat will control a mixing valve to regulate supply water temperature to the intermediate panels. Zone room thermostats will control flow of hot water to the intermediate panels.

Change-over thermostats will start to circulate chilled water to all ceiling panels when outdoor temperatures reach 60 deg F accompanied by sunshine or temperature rise above 74 deg. The chilled water temperature will be kept above room dew point (59 deg in this case) by an immersion thermostat in the chilled water supply line. Figure 2 is a schematic diagram of a typical intermediate panel control system.

Conditioned air supplied through ceiling diffusers will respond to variation of internal cooling load. Air handling units will be located in penthouse mechanical rooms; pumps and heat exchangers will be placed in basement mechanical rooms. A central heating and refrigeration plant will provide high temperature hot water and chilled water to terminal buildings and concourse buildings through underground tunnels.

Estimated total mechanical cost is ten million dollars. Construction of the airport is under the direction of George L. DeMent, Commissioner of Public Works for the City of Chicago. Operation of the airport is by the Department of Aviation, William E. Downes, Jr., Commissioner. Naess & Murphy, Chicago, is the Architect-Engineer.

Through-Roof Exhaust Fan Develops High Pressure for Duct Connections

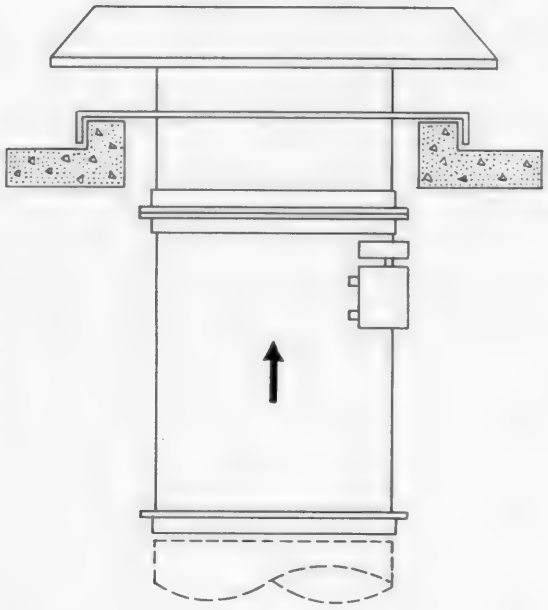
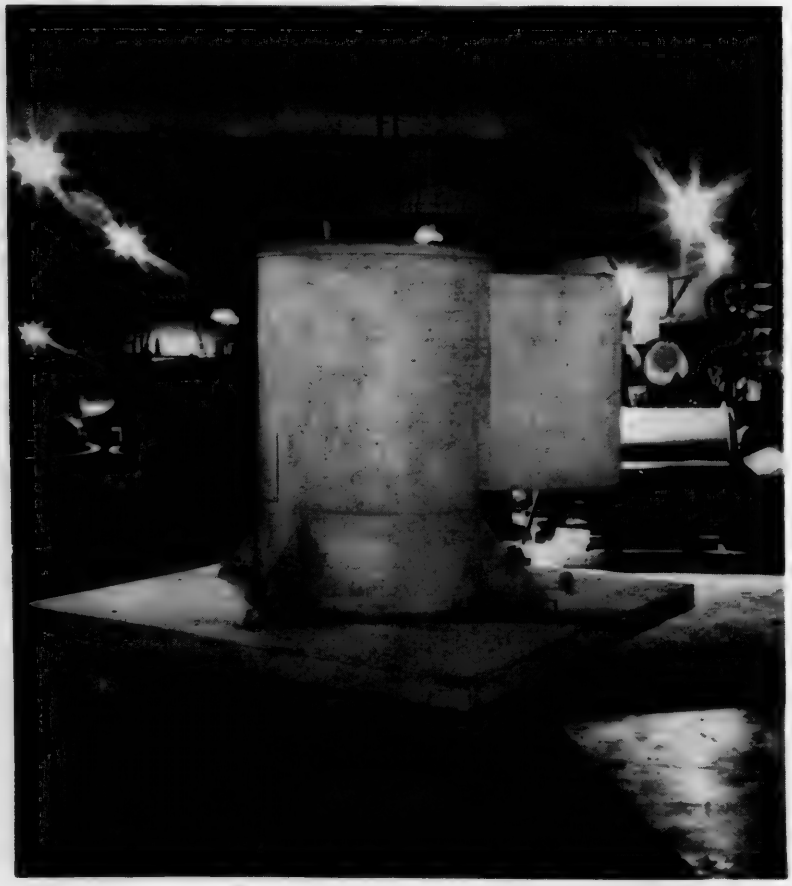


Fig. 1. Tubular centrifugal fans have many uses. Diagram at right shows its application as a low-contour roof exhauster, with roof plate, discharge hood, and connection to duct system.

Fig. 2. Tubular centrifugal exhaust fan in stack through roof as fabricated by Dryer Dynamics for a chemical plant. It develops up to 3 inches static pressure, pulling fumes through an extensive duct system. Fan in photo is 27½ inches in diameter, extends 42 inches above the roof plate, and is removable for servicing.



FUMES from many remote locations are exhausted by a tubular centrifugal fan mounted in a stack through the roof of a chemical plant. Developing static pressures up to 3 inches w.g. to permit connection to extensive ductwork, a group of such fans has been manufactured by Dryer Dynamics Corp., Lyndhurst, N. J., for a leading chemical manufacturer.

Static pressure of these fans is appreciably higher than the ¾ inch common in roof exhausters, insufficient to overcome the resistance of ducts of any length. Spray galvanizing protects the fans against corrosion, although epoxy resin or other non-corrosive finishes may be used. The fan housing is the base of the stack, which will be welded to the upper flange. (See photo and drawing.)

Stack-mounted tubular centrifugal exhaust fans may also be constructed with bearings in a through-vented compartment, open to the atmosphere, completely isolating the bearing chamber from the corrosive gas stream.

OPTIMUM ANGLES FOR SOLAR COLLECTORS

(Continued from page 60)

The above total is for half a day. It must be multiplied by 2 and the number of days of the month to give the total available solar transmission for June, when angle $\phi = 40°$: 1,058 × 2 × 30 = 63,480 Btu per sq ft.

This information is plotted in Fig. 8 as point *W*. It assumes 100% solar collector efficiency. Actual heat available from the collector will be much less, depending on collector efficiency. Similar calculations for other values of angle ϕ give the June curve in Fig. 8. In other words, the information given in Fig. 7 yields the June curve in Fig. 8. Similar families of curves yield the July-May curve, etc. The total available solar transmission, in Btu per square foot of collector surface, represents the monthly maximum which can be obtained with a 100% efficient collector. However collector efficiency does not influence determination of optimum collector angle.

Fig. 8 shows that to get optimum results from a collector in June, the inclination angle ϕ must be fixed at 10°; for optimum results in December, angle ϕ must be 68°. To get optimum results over a period of 12 months, other considerations must be taken into account. Those months which have a greater percentage of available sunshine will have a greater influence on the determination of the collector inclination angle. Therefore the notion of "percentage of available sunshine" must be introduced. This percentage can be acquired by studying meteorological records over a period of time and applying a factor of judgment to arrive at reasonable figures.

If the monthly percentage of sunshine of a locality is known, it is now possible to determine the optimum collector inclination angle ϕ for that locality, as shown by Example 4.

Example 4:

Given: A town, at 40° latitude, where the monthly percentage of sunshine is as follows:

June	60%	December	55%
July	55%	January	55%
August	65%	February	55%
September	70%	March	60%
October	55%	April	55%
November	50%	May	60%

Required: The optimum collector inclination angle ϕ.

Solution: Assume angle $\phi = 40°$ and investigate June. As calculated above, total available solar transmission is 63,480 Btu per sq ft, but since the percentage of sunshine is 60% this amount will be reduced to 38,088 Btu.

The same result can be obtained from Fig. 8. Enter at 40°, go up to June curve, go right horizontally, follow the guide lines to the 60% line, and read result at the right. The result is 38,100 Btu. This procedure is repeated for the other months. The results are as follows:

Total solar transmission received by the solar collector fixed at Angle $\phi = 40°$:

June	38,100 Btu per sq ft
July	36,600
August	45,000
September	46,000
October	32,000
November	23,000
December	24,200
January	25,000
February	32,000
March	40,000
April	38,000
May	39,700
Annual total	419,600 Btu per sq ft

The same procedure is repeated for other values of angle ϕ:

Annual solar transmission received by the solar collector:

Angle ϕ	
25°	416,500 Btu per sq ft
30°	422,900
35°	421,800
40″	419,600

For this particular locality, a collector inclination angle of 30° will give optimum results. If further accuracy is desired other angles, near 30°, may be investigated.

Figure 8 provides a tool for those who wish to analyze the behaviour of fixed flat solar collectors located at 40° north latitude. With the help of Fig. 8 and meteorological data on the monthly percentage of available sunshine, the determination of the optimum collector inclination angle becomes a simple procedure.

Reference

Design Data 3X-51 PD1, Carrier Corporation.

NEW LITERATURE

Use the prepaid yellow postcard in the back of the magazine for securing your copies of these catalogs.

Ductile Iron Pipe Fittings

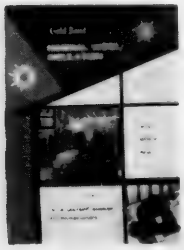
An illustrated 12-page catalog on its complete line of ductile iron pipe fittings is announced by The Kuhns Bros. Co., Dayton, Ohio. Catalog 3PF includes ductile screwed fittings, Pipe Lock coupplings, flanges and flanged fittings, and hexagon bushings and plugs.

Circle **Item 1** on Inquiry Card

Mechanical Draft Inducer

Four-page Bulletin 234, from Stamford Fan Co., Inc., Stamford, Conn., describes the heavy-duty MID draft inducer, made in 7 sizes to handle a fuel burning equivalent of 12 to 130 gph of fuel oil. Includes dimensions, specifications, and pertinent engineering data.

Circle **Item 2** on Inquiry Card



Insulation Selection

An 8-page consumer-type booklet is offered by National Gypsum Co., Buffalo, N. Y., to simplify the selection of mineral wool insulation by the average homeowner. Installation procedures are outlined in simple terms. Covers electric heating and air conditioning.

Circle **Item 3** on Inquiry Card

Infrared Radiant Heating

Infrared radiant heating gives "square foot answers to cubic foot problems". Equipment for this type of electric heating is manufactured by Fostoria Corp., Fostoria, Ohio, and is described in 4-page Form 61-701, which lists advantages as economical, quick, silent and clean.

Circle **Item 4** on Inquiry Card

Roof-Mounted Units

Describing the application and installation of Melco Roof-Top year-round air conditioning units on single story buildings, 24-page Brochure RT-B1 is available from Melchior, Armstrong, Dessau Inc., Ridgefield, N. J. Includes complete specifications.

Circle **Item 5** on Inquiry Card

Cooling Tower

Called a new concept in cooling tower performance, poundage and plan area, the lightweight steel Compac-Tower is manufactured by The Marley Co., Kansas City, Mo. A 6-page bulletin describes the tower, and includes dimensional data, performance data, and specifications.

Circle **Item 6** on Inquiry Card

Sound, Vibration Eliminators

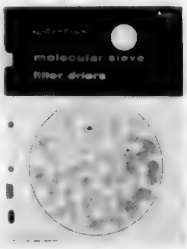
Catalog 890, published by General Rubber Corp., Tenafly, N. J., covers its SoundZorber line of flexible, wire-reinforced rubber sound and vibration eliminators, designed and constructed to eliminate this type of disturbance in pipelines on heating and air conditioning systems.

Circle **Item 7** on Inquiry Card

Split-Body Control Valves

Conoflow Corp., Philadelphia, Pa., offers a 16-page bulletin describing the company's complete line of Series LB all-purpose split-body control valves. Bulletin LB-4 gives details of construction and operation, and points out numerous maintenance-saving features of the design.

Circle **Item 8** on Inquiry Card



Filter Driers

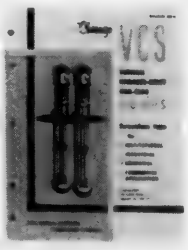
Describing how Detroit molecular sieve filter driers of 8 different types provide efficient drying, filtering and acid removal in refrigeration and air conditioning systems, a 6-page technical bulletin (276-A) is issued by American-Standard Controls Div., Detroit, Mich.

Circle **Item 9** on Inquiry Card

Registers and Grilles

Forty-page Catalog No. 61, describing a full line of wall grilles, Fabricated cold air faces, registers and grilles, is available from The Independent Register Co., Cleveland, Ohio. Catalog contains sizes and diagrams of all products for both heating and cooling systems.

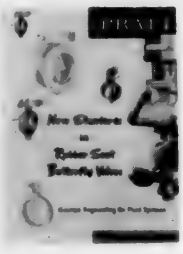
Circle **Item 10** on Inquiry Card



Non-Clog Pumps

A new approach in bulletin layout and content is used by Chicago Pump —Hydrodynamics Div., Food Machinery and Chemical Corp., Chicago, Ill., to introduce its line of vertical, enclosed-shaft, non-clog VCS pumps. Bulletin 124-G contains 16 pages of useful application data.

Circle **Item 11** on Inquiry Card



Butterfly Valves

Henry Pratt Co., Chicago, Ill., has published a 4-page bulletin which describes completely new designs in rubber seat butterfly valves. Bulletin 6 covers models from 3 to 144 inches and pressures from vacuum to 150 psi. Dimensional data are included.

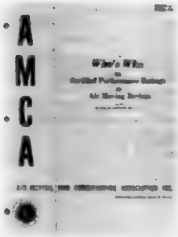
Circle **Item 12** on Inquiry Card

Use the prepaid yellow postcard in the back of the magazine for securing your copies of these catalogs.

Strainers

O. C. Keckley Co., Skokie, Ill., announces 24-page Catalog No. 61, in which both Y-type and basket strainers are described and illustrated. Product information is supplemented by engineering data, such as free area to pipe area ratios, and pressure drop charts.

Circle **Item 13** on Inquiry Card



Air Moving Devices

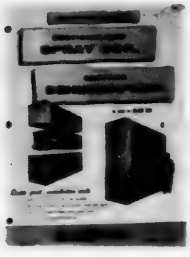
"Who's Who in Certified Performance Ratings in Air Moving Devices" contains the names of all manufacturers whose products have been licensed to use the AMCA (Air Moving and Conditioning Association, Inc., Detroit, Mich.) Certified Rated Performance Seal.

Circle **Item 14** on Inquiry Card

Electrostatic Precipitators

A 12-page illustrated bulletin (No. 2128) describing a new line of electrostatic precipitators is available from American-Standard Industrial Div., Detroit, Mich. Bulletin discusses the air pollution problem in general and how it is solved with this type of unit.

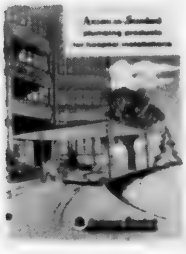
Circle **Item 15** on Inquiry Card



Spray Coil Dehumidifiers

Eight-page Bulletin SCD-1 covering a new line of sectionalized spray coil surface dehumidifiers in sizes to 50,000 cfm is announced by Blazer Corp., Passaic, N. J. Bulletin includes construction features, dimensions and weights of these units, which reduce installation costs.

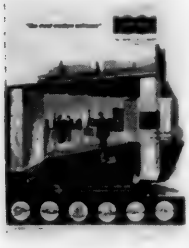
Circle **Item 16** on Inquiry Card



Hospital Plumbing Fixtures

A 44-page guide to the selection of hospital plumbing products is issued by American-Standard Plumbing & Heating Div., New York, N. Y. Catalog illustrates fixtures and details general and specific applications in various hospital areas: surgical, obstetrics, diagnostic, etc.

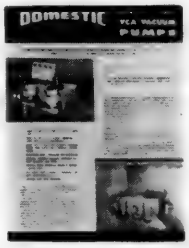
Circle **Item 17** on Inquiry Card



Commercial Air Entrances

Its packaged and modular products which provide air entrances for various sizes of commercial buildings are described in a brochure published by Air Door, Inc., New Castle, Ind. Brochure begins with a history of the air entrance, and describes the company's U.S. concept.

Circle **Item 18** on Inquiry Card



Vacuum Heating Pumps

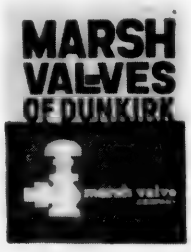
Available from Domestic Pump & Manufacturing Corp., Shippensburg, Pa., is 4-page Bulletin S153 which describes the VCA line of vacuum heating pumps. Units have individually sized and separately controlled vacuum and condensate pumps. Includes performance data.

Circle **Item 19** on Inquiry Card

Industrial Reproduction Processes

A newsletter, designed to present the latest industrial reproduction processes and materials, is announced by Eastman Kodak Co., Rochester, N. Y. Called "The Kodak Compass", it will, 3 or 4 times a year, describe developments in drawing and reproduction techniques.

Circle **Item 20** on Inquiry Card



Valves

24-page Catalog MV-615 covers the complete valve line produced by Marsh Valve Co., Dunkirk, N. Y. Catalog contains full details and specifications, as well as diagrams and roughing-in dimensions, on 28 categories of valves for industrial commercial and domestic uses.

Circle **Item 21** on Inquiry Card

Central Air Conditioners

Catalog 560, issued by McQuay, Inc., Minneapolis, Minn., describes the Seasonmaster central air conditioning line. The 60-page catalog provides detailed data to aid selection of unit type and size, cooling and heating coils, fan speed, motor horsepower, and accessories.

Circle **Item 22** on Inquiry Card

Centrifugal Pumps

The installation, servicing and maintenance of centrifugal pumps are covered in an 18-page bulletin published by Worthington Corp., Harrison, N. J. Useful information in Bulletin G-2971 includes storage, foundation construction, alignment, piping and starting.

Circle **Item 23** on Inquiry Card

Self-Operated Regulators

Economical temperature and distillation rate control of domestic hot water with self-operated regulators is described, with diagrams, in six application guides offered by Spence Engineering Co., Inc., Walden, N. Y. Includes hot water distribution, washroom water supply.

Circle **Item 24** on Inquiry Card

Use the prepaid yellow postcard in the back of the magazine for securing your copies of these catalogs.

Flexible Duct Connectors

When and where to specify various types of time-saving Silent Duct flexible duct connectors is covered in a 4-page bulletin published by Elgen Manufacturing Co., Long Island City, N. Y. Also described is the Quadra-Matic heavy-duty damper control for high velocity systems.

Circle **Item 25** on Inquiry Card

Extruded Aluminum Louvers

Extruded aluminum louvers are manufactured by Construction Specialties, Inc., Cranford, N. J., in four basic types: Fixed; operating; special; and screens, anchorages and finishes. A 20-page bulletin describes each type, and contains information on various louver controls available.

Circle **Item 31** on Inquiry Card

Air-Handling Troffer

What is described as a completely new concept in airhandling troffers was announced by Benjamin Div., Thomas Industries Inc., Louisville, Ky., and Tuttle & Bailey, New Britain, Conn. A 12-page bulletin gives full descriptive and selection data for Triple-Shell Lumi-Flo units.

Circle **Item 26** on Inquiry Card

Electronic Air Cleaner

The Electro-Cell electronic air cleaner is described in a 16-page bulletin (No. 258B) by American Air Filter Co., Inc., Louisville, Ky. Bulletin contains design features, maintenance, capacities and dimensions for high-velocity and packaged type units.

Circle **Item 32** on Inquiry Card

Centrifugal Roof Ventilator

Complete engineering data on its Centridyne low-silhouette centrifugal roof ventilator are published in a 4-page bulletin by Western Engineering & Mfg. Co., Los Angeles, Calif. Bulletin CV61 includes performance details and construction features and specifications.

Circle **Item 27** on Inquiry Card

Spreader Stokers

Spreader stokers designed to burn all types of refuse fuels, either separately or in conjunction with conventional fuels (coal, oil, gas), are the subject of a 12-page bulletin offered by Detroit Stoker Co., Monroe, Mich. Includes installation diagrams and photos.

Circle **Item 33** on Inquiry Card

High-Efficiency Air Filters

High-efficiency air filters, called Aerosolve Series II, are described in 8-page Bulletin 132 by Cambridge Filter Corp., Syracuse, N. Y. Bulletin covers types available, typical applications, performance and sound characteristics, and a prototype specification.

Circle **Item 28** on Inquiry Card

Fan-Coil Unit Controls

Electric controls for fan-coil units are described in a 6-page bulletin published by Minneapolis-Honeywell Regulator Co., Minneapolis, Minn. Information is also offered regarding a new contract concept, called "superintended jobs", which applies to these controls.

Circle **Item 34** on Inquiry Card

Air Diffusers

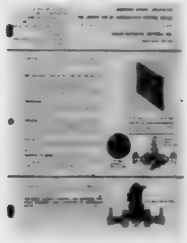
Agitair Roto-Jet diffusers are extruded aluminum, adjustable units designed to provide long projection or modulated diffusion of conditioned air. Air Devices, Inc., New York, N. Y., offers an 8-page bulletin containing descriptive and selection data for these units.

Circle **Item 29** on Inquiry Card

Oil Mist Precipitator

Air contamination due to oil mist in industrial plants can be effectively checked by means of the Trion Type OMP oil mist precipitator. Units are described by Trion, Inc., McKees Rocks, Pa., in a 4-page bulletin which includes hood and duct design, unit sizing and installation.

Circle **Item 35** on Inquiry Card



Thermostatic Control Valves

A condensed catalog illustrating and describing its line of thermostatic control valves is available from Lawler Automatic Control Valves, Mount Vernon, N. Y. Four-page Bulletin C-8 includes shower mixing valves, temperature regulators, tempering valves, others.

Circle **Item 30** on Inquiry Card

Ventilator Calculator

A slide rule calculator designed by Penn Ventilator Co., Inc., Philadelphia 40, Pa., to help the engineer properly size gravity roof ventilators and extruded aluminum louver houses is available by letterhead request. Answers are rapid and accurate due to condensation of extensive engineering data.

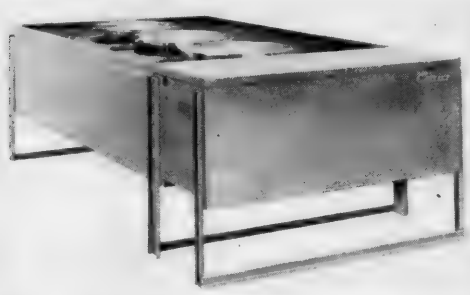
NEWS OF EQUIPMENT AND MATERIALS

Use the convenient prepaid yellow postcard in the back of the magazine for securing more information about new equipment and materials described in this department.

15-Ton Heat Pump

Carrier Air Conditioning Co., Syracuse, N. Y., introduces indoor and outdoor heat pump sections with a nominal capacity of 15 tons, designed to meet a wide range of climatic conditions and applications.

The outdoor section (illustrated) has a low silhouette, only 20¾ inches high, and its legs can be adjusted to heights of 12 or 18 inches so that it is usually invisible from the ground when installed on rooftops. Three vertical discharge propeller type fans move 13,000 cfm at a low sound level.



At 95 deg F outdoor temperature and 67 deg wet bulb indoors, the heat pump produces 173,000 Btu of cooling. At 40 deg outdoor temperature and 70 deg indoors, it produces 162,000 Btu of heating. As many as three accessory electric heaters of 19.1 Kw each may be mounted on the fan deck.

Operating costs are reduced by a defrost cycle that occurs every 60 minutes, but only when outdoor temperatures require it.

More Information? Circle Item 36 on Inquiry Card.

New Wall Closet Support System

What is described as a revolutionary break-through in the design of modern wall closet supports to allow up to 19 off-the-floor siphon-jet closets in a horizontal battery on a single vertical stack—even when installed on thin, reinforced monolithic slabs — has been achieved by Hydromechanics Div., Zurn Industries, Inc., Erie, Pa.

Called the Zurn Monolithic system, the behind-the-wall supporting medium promises to save thousands of dollars in structural work and solves highly critical slab problems which hitherto restricted the number of off-the-floor water closets which could be installed economically in one continuous battery.

With the newer modes of floor construction — such as, reinforced monolithic slabs having a thin finishing layer of asphalt or ceramic tile — the units stay completely above the slab. Thus they eliminate the need for recessing or chipping into the slab at low points in the drainage run — conditions which previously impaired the structural strength of the slab or required costly structural design modification and fabrication.

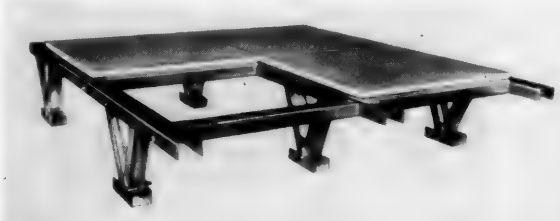
With thicker slab-and-fill design decks, the system eliminates the expense of depressing slabs, pouring costly floor fills, and making time-consuming on-the-job alterations to structural slabs — all necessary innovations when conventional supports are used to achieve a long run of wall closets.

In addition, the unit accommodates all fixture manufacturers' siphon-jet bowls, and features one universal face plate which adjusts to all closet roughing heights within a prescribed range of standard drainage pitches and closet spacing dimensions. A unique "increment removal" plate located at the extreme bottom portion of the face plate makes these advantages possible.

More Information? Circle Item 37 on Inquiry Card.

Elevated Flooring

Strato-Floor is a new type of elevated flooring particularly designed for use in electronic computer installations, or wherever extensive piping, duct and wiring systems require under-the-floor space and immediate accessibility. It is manufactured by Strato-Floor, Inc., Cleveland, Ohio.



The Strato-Floor sub-structure is a carefully engineered grid support system which is said to offer greater strength and rigidity without excessive bulk or weight.

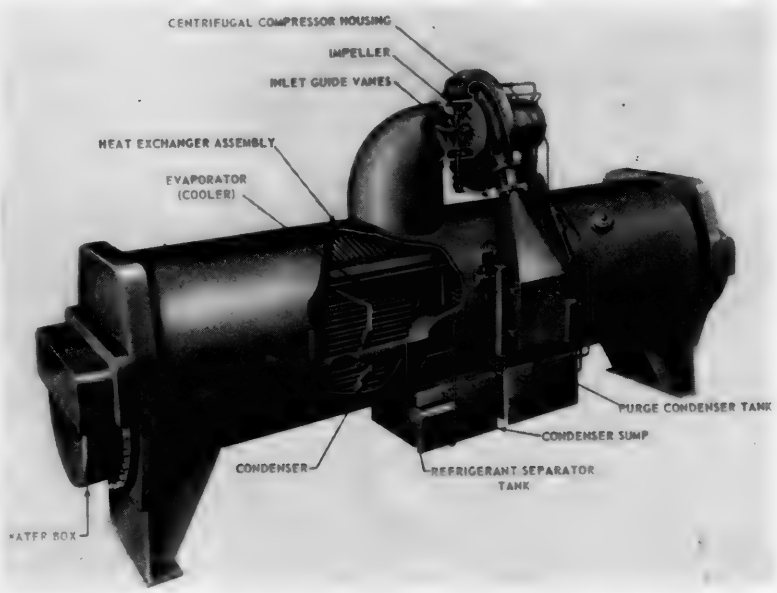
Steel stringers are firmly bolted to a new kind of adjustable jack. Deflection is claimed to be minimized under even the heaviest loads. The floor is designed to support a live load of 250 lb per square foot, and a point lead of 1000 lb. Panels are 24 x 24-inch modular units.

More Information? Circle Item 38 on Inquiry Card.

Hermetic Centrifugal Packaged Chiller Line Introduced:

Eight Compact, High-Speed Sizes Available

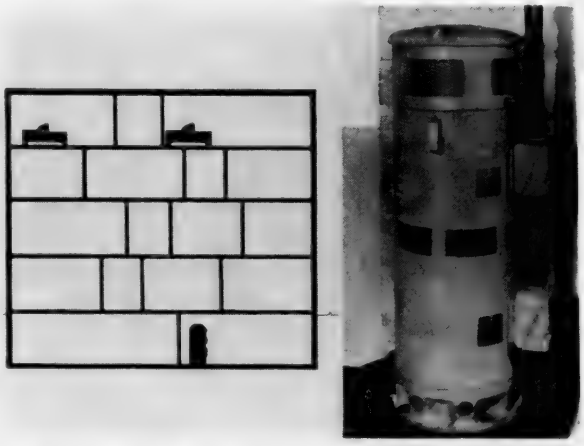
WHAT IS SEEN AS A MAJOR ADVANCE in the design of refrigeration equipment was introduced last month by American-Standard Industrial Division, Detroit, Mich. Called the Packaged Tonrac (a play on words: Tonrac spelled backwards is Carnot, the reverse of whose cycle is "ideal" refrigeration) the hermetic centrifugal unit has been under development for more than five years. Now available in eight size increments from 50 to 100-ton nominal refrigeration capacity, the machine features substantial reductions in size and weight as compared with conventional centrifugal equipment.



The Packaged Tonrac is intended for use as the heart of central station air conditioning systems, providing chilled water for operation of zone or individual room conditioners in hospitals, schools, small office buildings, super markets, motels, small hotels, small industrial plants and other structures of similar nature. The packaged design is completely piped and factory-insulated; it requires no auxiliary water piping, refrigerant piping or control tubing installation on the job site.

As seen in top photo, the basic unit consists of a centrifugal compressor with its electric drive motor, a heat exchanger section consisting of condenser and cooler portions plus necessary piping, valves and controls. Power is supplied from a separate motor-generator-exciter power unit which converts 60-cycle line current to 300-cycle current for the Tonrac motor.

The power unit, seen at right in bottom photo, can be located at the most convenient spot wherever it can be protected from the elements; it need not be located adjacent to the refrigeration machine (or machines, if more than one is served by a single power unit). The power unit generator can be operated from any rotary prime mover, a point of considerable value in areas where steam or natural gas are less costly than electric power. This also permits use of steam turbines or internal combustion engines as stand-by power sources in the event of an electrical power failure. This is of particular value in installations where air conditioning may be considered a functional part of the work performed, as in the case of comfort air conditioning in a hospital or process water or chemical chilling in an industrial plant.



Reduced floor space requirement is a major feature of the equipment. The next smallest conventional centrifugal machine produced in the 105-ton capacity size occupies 87% more floor area than the Packaged Tonrac. Other units occupy nearly three times the floor area.

An important advantage in size reduction, particularly where a chilled water system is to be installed in an existing building, is the fact that the completely assembled machine will pass through a standard 36-inch wide doorway. This means that walls need not be knocked out to admit the unit. In the case of new construction, this size feature permits completion of walls and partitions that normally must await delivery of the refrigeration machine, a situation which sometimes imposes a penalty on con-

tractors and architects in terms of time and labor cost.

Reduced weight is significant in that it results in lower rigging and installation costs. In addition, upper floor installations using lighter, less expensive structural supports are possible.

Another outstanding achievement reported for the new design is the liquid-refrigerant-cooled electric motor that drives the centrifugal compressor. In the 100-hp size it weighs less than 1/10 as much as any electric motor of comparable capacity commercially produced today.

The Tonrac motor operates at 18,000 rpm nominal speed on 480 volt, 3-phase, 300 cycle current from the power unit. This speed was selected as the best possible for the performance characteristics of 50 to 100-hp centrifugal compressors using Refrigerant 11.

Another design accomplishment is the integral compressorless purge system. Conventional machines use an auxiliary reciprocating compressor to handle purging of foul gases (air-water-refrigerant mixture) that accumulate in the condenser portion of the heat exchanger during normal usage. In the Packaged Tonrac machine, the pressure differential, which always exists between condenser and cooler is utilized to exhaust foul gases from the condenser. This eliminates the need for the separate reciprocating compressor and attendant undesirable conditions.

Factory-installed insulation, which blankets the complete packaged unit, reduces on-site installation costs. The Package Tonrac is fully insulated, including the water boxes, as delivered to the job.

More Information? Circle Item 39 on Inquiry Card.

Gas-Fired Boilers

Mueller Climatrol Div., Worthington Corp., Milwaukee, Wis., announces a new series of gas-fired boilers which are designed for commercial and large residential installations.

All Type 22 boilers are shipped disassembled to assure easy handling to installation sites. This is of particular importance to the growing replacement market where access to existing heating plants is limited.

Improved boiler sections provide 7% greater Btuh capacity than previous models. A seven-section boiler of 450,000 Btuh input required only 9.4 sq ft of floor space. All sections are of parallel ground construction to eliminate the need for putty between sections and assure absolute fit between sections.

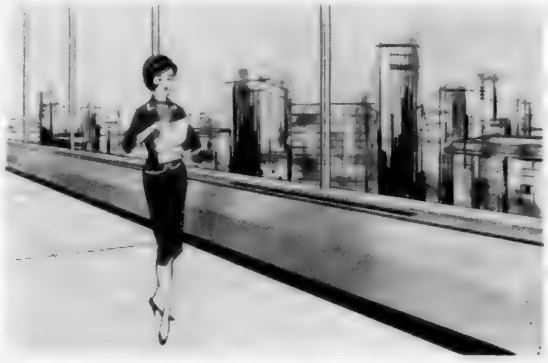
Type 22 boilers are available in sizes ranging from a three-section 150,000 Btuh input to a ten-section 675,000 Btuh input model; for steam or hot water, gravity or forced circulation.

More Information? Circle Item 40 on Inquiry Card.

Induction Air Conditioners

A line of induction room air conditioners, which feature a new concept in cabinet styling and occupy up to 26% less floor space than other units, is announced by The Trane Co., La Crosse, Wis.

The new induction UniTrane line has a front panel that is unbroken by recirculated air grille work. Secondary air is drawn in through a concealed opening in the kick space under the unit. Outlet grilles are concealed in the cabinet top.



Matching enclosures are available to join more than one unit in a continuous wall-to-wall cabinet. The unbroken lines of the continuous cabinet installation are said to present a cleaner, more modern appearance.

In the engineering of the induction unit, particular attention was paid to the problem of noise. Several sound attenuating features have been incorporated in the design. The manufacturer claims unusually low noise levels.

Eight nozzle arrangements, five unit sizes and three coils—plus the wide range of available models—allow a selection flexibility which assures the most economical installation and operating costs, the company states. This selection flexibility eliminates costly "over-selection" and, in addition to optimum unit application, permits the use of minimum primary air supply, smaller ducts and fan motors.

More Information? Circle Item 41 on Inquiry Card.

Pipe Jacketing Introduced

A practical method of compensating effects of weathering on insulation covering outdoor runs of piping or ductwork for as long as twenty years is announced by American Sisalkraft Co., Division of St. Regis Paper Co., Attleboro, Mass. It is a laminated facing material consisting of aluminum foil, glass reinforcing strands and E. I. Du Pont's new polyvinyl fluoride film, called Tedlar. Bonding these sheets together is Pyro-Kure, American Sisalkraft's self-extinguishing adhesive.

More Information? Circle Item 42 on Inquiry Card.

Replacement Controls

Minneapolis-Honeywell Regulator Co., Minneapolis, Minn., has instituted a sweeping new marketing program aimed at solving a major industry problem —that faced by wholesalers and dealers in providing replacements for the thousands of different residential heating and cooling controls now in use.

The company's solution is a newly-engineered line of 170 specialized, adaptable controls which, the company said, will replace more than 93% of the 18,000 variations of residential control items now sold, by both Honeywell and competitors.

The new replacements, called Tradeline controls, include four specialized thermostats (one is illustrated) that will replace the 133 Honeywell thermostats used in today's standard home installations, plus hundreds of competitive models and scores of discontinued models still installed and working.

A single Tradeline oil burner relay will replace the 49 oil burner relay models now currently listed in the firm's factory specification book. Three special Tradeline gas valves will replace all 49 Honeywell gas valves currently used for home installations.

More Information? Circle Item 43 on Inquiry Card.

Group Washing Developments

New product developments were introduced by Bradley Washfountain Co., Milwaukee, Wis., at the National Plumbing-Heating-Cooling Exposition in Detroit.

An integral stop, strainer, and check valve is an accessory which will replace three fittings on the Bradley Washfountains, which are used in industrial plants, schools, and institutions, or wherever group washing is employed.

The valve is constructed in logical order. Water passes through the stop first, making it possible to employ the stop in maintaining strainer and check as well as the mixing valve. The strainer, placed ahead of the check, protects the latter from foreign objects. The valve will receive a regular ½-inch pipe connection or a 13-inch length of copper tubing, which accompanies the valve, for flexible connections.

Also introduced at the exposition was an adjustable shower head for column showers. A twist of the barrel will adjust the water flow from a fine spray, through intermediate stages, to a solid stream of water. The shower head is constructed of chrome-plated brass with interior stainless steel guide discs. The new shower head incorporates the company's previous vertical angle adjustment.

Accompanying the adjustable shower head on the column shower is a new metered soap dispenser which virtually eliminates soap waste and the spilling of excess soap on shower room floors as a safety hazard and maintenance problem. The metered soap dispenser operates from a soap container located inside the shower column, but is easily refillable from an exterior tamper-proof orifice.

More Information? Circle Item 44 on Inquiry Card.

Infra-Red Plumbers Furnace

Plumbers and utility linemen can slash fuel costs and metal losses by 75% with the L & W Infra-Red plumbers furnace, according to L & W Div., Wagner Products Corp., St. Petersburg, Fla. Savings will pay for the furnace in less than two months, it is estimated.

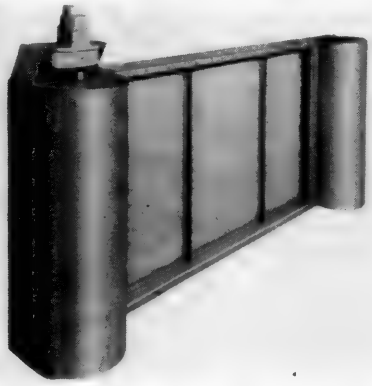
The fifty pound capacity furnace is equipped with a cast iron melting pot mounted over a 12,000 Btu Perfection Schwank infra-red burner. The burner melts lead by transferring heat by radiation rather than contact of flame on the melting pot. It is equipped with control valve and pressure regulator and may be operated on either bottled propane or natural gas.

Tests by the manufacturer indicate that lead losses with the L & W furnace amount to less than ½ pound for each 20 pounds melted, in contrast to the loss of two pounds for every 20 pounds melted in a regular furnace. Besides reducing the time lost in skimming off slag, the reduced metal loss provides an annual saving of $390 if the furnace is used at a rate of 20 pounds per hour for 2000 hours with lead costing $.13 a pound. It is also reported that large fuel savings result from the efficiency of the burner.

More Information? Circle Item 45 on Inquiry Card.

Air Filter Offers Versatility

A versatile roll-type air cleaner that will operate efficiently "anywhere" is announced by Farr Company, Los Angeles, Calif. Known as the Roll-Kleen Model H-5 (H for horizontal media movement; 5, the fifth in this series), the latest design is said to provide the most wanted features requested by manufacturers of air handling equipment.



The H-5 is available with automatic (motorized and controlled operation) or manual drives, with or without media covers on either or both ends, and is manufactured in 84 standard sizes. These features, plus the reduction in the number of moving parts and a new simplified method of media loading, make the H-5 well suited for use with the latest model air handling devices.

Air cleaner is designed for installation in a variety of positions regardless of the direction of air flow. Media movement can be in either direction.

More Information? Circle Item 46 on Inquiry Card.

Stainless Steel Jacketing

A seminar that described the remarkable properties of stainless steel as insulation jacketing for industrial pipelines was conducted recently by Union Carbide Metals Co., New York, N.Y.

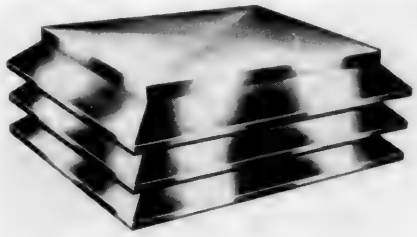
The material was recently developed as a joint venture of UCM and Union Carbide Chemicals Co., both divisions of Union Carbide Corp. It was produced by Johns-Manville Corp. for 20,000 sq ft of pipeline at the Chemicals Company plants in West Virginia.

As the four most important requirements of insulation jacketing, the panel participants at the seminar selected (1) fire resistance, (2) strength, (3) corrosion resistance, and (4) low surface temperature for safety of personnel. In each of these four categories, stainless steel proved more effective than other materials tested, it was reported.

More Information? Circle Item 47 on Inquiry Card.

Low Silhouette Exhauster

According to Penn Ventilator Co., Inc., Philadelphia, Pa., the Linea is a high quality, low silhouette exhauster cased in an attractive, compact, extruded aluminum louver housing. Storm-proven louver blades give the unit an unbroken horizontal sweep that blends with and compliments natural building lines, the firm reports.



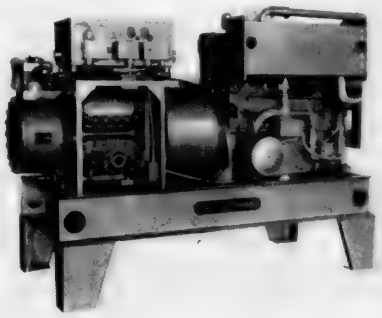
Available as a centrifugal roof exhauster, or provided with a propeller blade, the Linea is suitable in appearance and design for all ventilator work where a low, clean, attractive housing is required.

More Information? Circle Item 48 on Inquiry Card.

Natural Gas Compressor Unit

Recently introduced by The Ready-Power Co., Detroit, Mich., the Ready-Power Model T-C70, 70-ton natural gas compressor unit features compact design. New features are standardized control cabinets with individual reset safety controls, through-tube type engine heat exchangers, dry-type air cleaner and large reservoir oil pan with oil temperature stabilizer.

Capacity modulation is by engine speed reduction



in addition to cylinder unloading. Unloading of the compressor during starting and cycle cranking are provided, and a pump down cycle is used to stop the compressor. Unit is started and stopped automatically from thermostatic action.

Nearly identical units are available in similar configuration in nine sizes: 20, 25, 30, 40, 50, 55, 70, 80 and 110 tons.

More Information? Circle Item 49 on Inquiry Card.

Water Level Safety Switch

A water level safety switch designed to prevent pump damage due to insufficient liquid at the source or when pump loses its prime, is announced by U.S. Gauge Div., American Machine & Metals, Inc., Sellersville, Pa.

The new switch is designed for installations where bearings, packing glands and motor windings depend on pumped water for lubrication and cooling. Insufficient water flow could damage these parts. The USG device senses liquid flow by measurement of discharge pressure and automatically shuts system down when water level gets too low.

The water level safety switch mounts on the pump discharge line and is connected, in series, with the pump power supply. If after a predetermined period of time, pump discharge is not at a specified pressure level, a microswitch electrically disconnects the pump motor, stopping the system. At frequent intervals, automatic cycling of the pump will be initiated until the required conditions are satisfied by the flow capacity of the system.

More Information? Circle Item 50 on Inquiry Card.

New Gas/Oil Burner

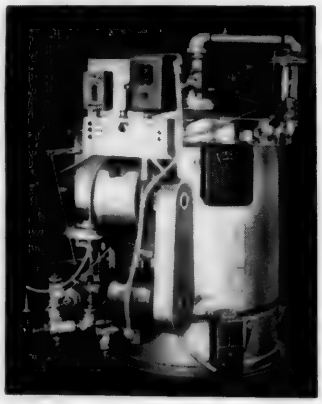
Webster Engineering Div., Midland-Ross Corp., Tulsa, Okla., has introduced completely redesigned and improved models of its Cyclonetic burner. Designed Model J, the two sizes immediately available offer input ranges from 700 to 2,250 mbtu/hr and 1,400 to 4,200 mbtu/hr respectively. Both models are offered as single or dual fuel burners for any fuel gas or No. 2 fuel oil, arranged for either pedestal or suspended flange mounting.

The burner is a factory assembled, wired and tested package incorporating a unique combustion head design which assures positive flame retention for quiet, stable combustion. Suitable for positive or negative furnace pressures in any type of boiler or furnace, optimum efficiency is achieved with surprisingly low motor horsepower on both gas and oil operation, the firm reports.

More Information? Circle Item 51 on Inquiry Card.

Separate Steam Superheater

A separately fired steam superheater has been developed by Vapor Heating Corp., Chicago, Ill. The unit features completely automatic operation, pneumatically operated temperature control, electronic outfire control protection, and conforms to ASME requirements; is Hartford inspected, and approved by U.L. and National Board. A typical installation is in the Lancaster College of Technology where it is used for testing turbines.



The superheater is completely packaged, factory tested and adjusted. Design temperatures extend to 1000 deg F with stainless steel heat exchange surface, and to 600 deg with alloy steel heat exchanger.

Unit is rated at 1,000,000 Btu per hr output and can be furnished gas or oil fired. Bulletin No. 4038 gives detailed specifications.

More Information? Circle Item 52 on Inquiry Card.

Motorized Globe Valve

Addition of a heavy-duty, "no stick" motorized globe valve to its line of hydronic zone controls is announced by White-Rodgers Co., St. Louis, Mo. The firm stresses that while the valve's primary use will probably be providing zone control of steam or hot water heating systems, many other types of application are feasible. Among them are flow control of steam, water, oil or air; control of liquid levels; maintenance of desired pressure conditions; automatic control of a complete process on a time or program basis.

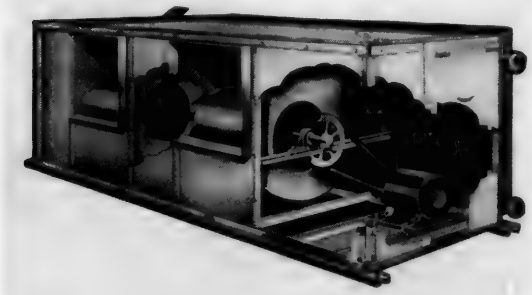
The rugged but compact valve entirely eliminates faulty performance due to sticking, the maker says. A powerful, lifetime-lubricated gear-motor operator opens the valve against the rated line pressure, without limitations of pressure imbalance. Models are available for pressures up to 150 psi.

More Information? Circle Item 53 on Inquiry Card.

Air Handling Units

Drayer-Hanson Div., Hi-Press Air Conditioning of America, Inc., Los Angeles, Calif., has released details on new units in the 500 to 35,000 cfm range, introduced to broaden its coverage of the commercial and industrial air conditioning markets.

Designated "FAM," the horizontal/vertical series of one and two-fan air movers are safety engineered



to obsolete use of belt guard. Motors are positioned inside the unit; a large full-entry access door has been provided. Models FAM-108 through 116 and FAM-208 through 230 carry weights from 295 to 3200 lb.

By a simple adaption in the field, coils and filter frame may be added externally to the unit, the manufacturer states.

More Information? Circle Item 54 on Inquiry Card.

Control for Electric Heating

A unique approach to the control of electric heating, based on an orderly sequence of operation as called for by the make or break of a low-voltage wall thermostat, is announced by Controls Company of America. Incorporating the approach is the new Model 36 control, product of the firm's Heating and Air Conditioning Div., Milwaukee, Wis.

In the control, a switching circuit ties together a number of 5-kilowatt-load modules to form a single unit. The modules consist of a load switch and two transfer switches that are operated by thermal expansion rods. Resulting operation is quiet, uniform, and orderly, with a time lapse of about 75 seconds between modules during the ON or OFF cycle.

The electric circuit is such that the current in the thermostat remains at a low uniform value to insure stable anticipation regardless of the number of heat banks in use.

In operation, the Model 36 activates or deactivates heater banks successively. A switch for the blower is tied to the first module, making the blower first on and last off. Load switches control the heat banks. One of each module's transfer switches prepares the hot rod in the succeeding module for action; the second takes the preceding hot rod load from the thermostat circuit and places it across the line.

A fast shut-off innovation is available to mechanically cut all the heater banks out of the circuit in the event of circulation failure. No holding relays are required in this fast shut-off process.

More Information? Circle Item 55 on Inquiry Card.

Heavy Duty Pipe Puller

The heavy duty Pow-r Mole was designed to push rod in any situation where pushing is possible and pull ½ to 3½-inch dia copper, steel, plastic pipe or tubing underground, faster, easier and more accurately. Manufacturer, Pow-r Devices, Inc., Clarence Center, N. Y., claims that due to unit's design, accur-

acy is exceptional when set up properly. It attaches to most standard tractor-mounted hydraulic back hoes.

One man can dig the trenches, attach and set up the unit, insert the rod sections and operate the tractor hydraulics. The unit comes complete with full set of cribbing, a 50-ft push rod, and pusher cap. By utilizing the furnished cribbing, the unit remains fixed in position throughout operation. Direction can be reversed by changing the position of the two drag springs, with no need to turn the pusher around.

More Information? Circle Item 56 on Inquiry Card.

Two-Way Full Flow Plug Valve

General Products Div., Hays Manufacturing Co., Erie, Pa., announces the development of a completely new plug valve for water, oil, gas and air service.

Called Nuseal, the non-freezing and non-galling valve features Teflon seal rings and Buna N rubber O-rings. Its bubble-tight shut off and leak-proof service have been proved through more than 50,000 cycles at pressures up to 125 psi.

More Information? Circle Item 57 on Inquiry Card.

Insulated Curtain Wall Panel

Elwin G. Smith & Co., Inc., Pittsburgh, Pa., has developed a field-assembled metal curtain wall, Panel K, incorporating 3-inch glass fiberboard insulation. The new panel eliminates girts to vertical spans of 16 ft, offsetting the cost of the thicker insulation. The wall has a U-factor of 0.10.

For each building story up to 16-ft height, Panel K will provide a smooth interior wall of vertical panels without girts or visible fastening. Exterior surface is available in the Shadowall (illustrated), Contourwall or Ribwall configuration, and in lengths to permit a curtain wall up to 60 ft in height without laps or visible fastening.

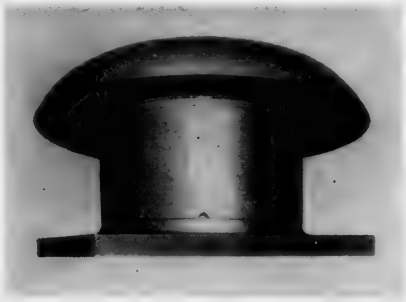
Either surface is supplied in aluminum, aluminized steel, galvanized steel or stainless steel with a choice of architectural color of bake-on transparent or opaque enamel.

More Information? Circle Item 58 on Inquiry Card.

Mushroom-Head Roof Ventilator

A new mushroom-head roof ventilator has been added to the line of industrial ventilating equipment manufactured by Hartzell Propeller Fan Co., Piqua, Ohio.

The ventilator was designed to meet a need for a completely rainproof low silhouette roof unit. It is available in 24, 28, 36 and 48-inch sizes, with a variety of fans available on each size.



Accessories available at extra cost include wire mesh bird screens and manual or motor operated shutters.

More Information? Circle Item 59 on Inquiry Card.

Mobile Air Cleaner

A completely mobile, compact electronic air cleaner, with a built-in activated charcoal filter panel for odor removal, is introduced by Trion, Inc., McKees Rocks, Pa.

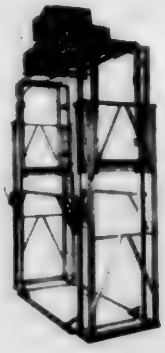
Enclosed in an attractive steel baked-enamel cabinet, only 32 inches long, 19½ inches high and 18½ inches deep, the Trion Model MAC is designed for use in restaurants, cocktail lounges, hotel and motel meeting rooms, offices or any application where localized clean, odor-free air is desirable.

Installation of the cleaner is simple; just plug the power cord into the nearest 115 v a-c outlet, adjust the fan switch for adequate air movement, and position the adjustable louvers to the desired direction of air flow. The unit requires no ductwork and no drain connections.

More Information? Circle Item 60 on Inquiry Card.

Portable Universal Lift

Model 1000 Alumalift, available from Amble Mfg. Co., Inc., Flushing, N.Y., is a universal lift which will raise 1000 lb to a range from 6 inches off the floor to 10 ft in height. It is completely portable, and assembles and disassembles in five minutes with eight ordinary wing nuts.



The heaviest section weighs only 80 lb and is 7 ft tall, in order that it will fit in a station wagon or standard elevator. The platform is 5 ft long, between uprights, and 2 ft wide.

A fork lift adapter is available so that one section alone may be used to raise units weighing up to 500 lb to 10 ft in height. This is suitable for raising air conditioners and installing pipe, duct or electrical fixtures.

More Information? Circle Item 61 on Inquiry Card.

NEW FROM BRYANT

EASY SECTION BY SECTION HANDLING

SERIES "D" 630 GAS BOILER

For new construction or replacement the advantages of the Bryant 630 Gas Boiler are obvious. Shown here is a section of one of the two 3,996,000 Btu/hr. input boilers being hoisted to the "utility tower" atop the new First New Haven National Bank in Hartford, Connecticut. The new Series "D" 630 boiler is available for water or steam. It has the new Bryant universal atmospheric cast iron burner with its superior flame characteristics, and easy adjustment to all gases, as well as to changes in their properties. You also get easier servicing and improved heat distribution across the boiler sections. Benefit by Bryant's 53 years of leadership and acceptance, factory and field assistance.

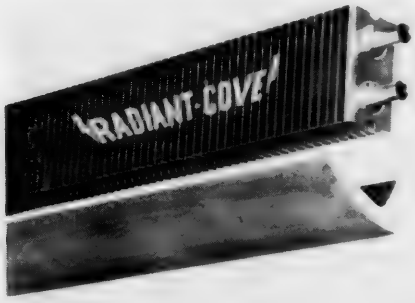
For details on the Series "D" 630 call your local Bryant Distributor or Factory Branch. Bryant Manufacturing Company, Indianapolis, Indiana.

bryant

ARCHITECT: Edwards Orr, New Haven, Connecticut. ENGINEERS: [illegible] Zeiss Haywood and Shadford, West Hartford, Connecticut. GENERAL CONTRACTOR: Fusco & Amatruda, [illegible] Connecticut. PLUMBING and HEATING CONTRACTORS: [illegible]ello, Inc., Hartford, Connecticut.

Valance-Type System

A valance-type system for hydronic heating and cooling, announced by Radiant Cove Manufacturing Co., Dunedin, Fla., utilizes a box-type fin, with double pass of ½ or ⅝-inch copper tubing. A molding-type trough, made of redwood sealed with glass fiber, receives all condensation.



The two copper tubes are hydraulically expanded within the fins to insure proper bond and good heat transfer. The tubes run parallel to each other, permitting either single or double passes and return.

The redwood trough, immediately below the fin tubing, receives all condensation, and also eliminates condensation forming on the exterior of the trough. The entire unit is held by brackets fastened to the wall within 12 inches of the ceiling. The tubing is easily and sturdily clipped into place, with vinyl plastic inserts between the clip and the tubing preventing any metallic noises.

More Information? Circle Item 62 on Inquiry Card.

Tropical Room Conditioner

A room air conditioner designed specifically for export to the Tropics and other areas where temperatures reach as high as 125 deg F is introduced by Amana Refrigeration, Inc., Amana, Iowa.

Designated Model 150-A-3R5, the unit incorporates special added condenser surfaces, a larger evaporator and additional tubing to insure efficient operation under high ambient conditions.

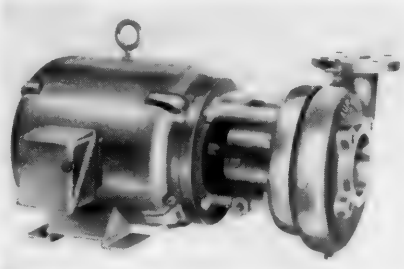
Extensive field tests indicate the unit will operate satisfactorily at temperatures of 120 to 125 deg, with voltage fluctuations plus or minus 10% of the rated 230 volts figure.

More Information? Circle Item 63 on Inquiry Card.

Close-Coupled End-Suction Pumps

Especially designed for high efficiency and practical economy, the new Type GBH Pumps, announced by Aurora Pump Div., The New York Air Brake Co., Aurora, Ill., provide required capacities and heads with less horsepower, reducing initial investment and operating costs.

Capacities range to 1600 gpm and heads to 330 ft. Maximum compactness with close-coupled end-suction design saves valuable space, permits fast installation, and makes these pumps especially suitable for OEM



applications, air conditioning systems, cooling towers, boiler feed, condenser circulation, and a wide variety of transfer, chemical, industrial and general services.

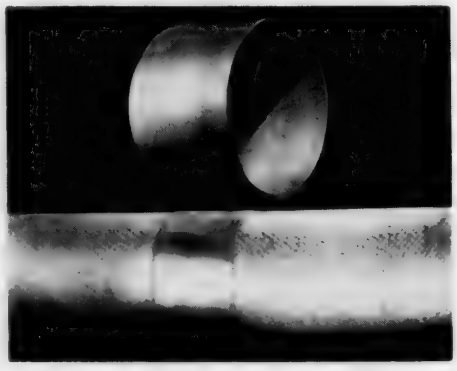
Conversion to accommodate change in operating conditions is fast and economical with completely interchangeable mechanical seal or packing inserts. Optional water jacketed inserts provide for accommodation of hot liquids up to 250 deg F.

More Information? Circle Item 64 on Inquiry Card.

Air Duct Coupling

A new coupling, for use with Transite air duct, has been designed by Johns-Manville Corp., New York, N.Y., to meet FHA Revision No. 3 to its Minimum Property Standards. The new Ductite coupling assures a watertight joint when used with J-M asbestos-cement duct.

Revision No. 3 calls for a restriction in the type of duct material acceptable for use below exterior finish grade and provision of watertight joints in such serv-



ice, and bans taped and cement-grout joints in such service. The combination of the new Ductite coupling and Transite air duct is designed to meet every requirement of this revision.

More Information? Circle Item 65 on Inquiry Card.

. . . I can get just the fin spacing, tonnage and CFM I want."

Now, Halstead & Mitchell gives you a choice of 6, 7, 8 or 10 fins per inch . . . makes it much easier to match a central fan-coil unit to a particular job or to meet specifications.

And look what else H&M offers: a selection of three coil face areas for each model; direct expansion or chilled water cooling coils (1 to 8 rows); hot water, standard steam or non-freeze steam heating coils (1 or 2 rows); cooling capacities of 3 to 92 nominal tons with 880 to 47,750 CFM; Turbu-Flo coils arranged for right or left-hand connections; horizontal or vertical mounting for discharge in any direction . . . and every accessory item you need to simplify your installation.

Why don't you check H&M Central System Air Conditioners? Call your wholesaler or write for Bulletin AHU-100. Halstead & Mitchell Co., Dept. B8. Bessemer Bldg., Pittsburgh 22, Pa.

Export Representatives: Sabal-Kielman, Inc., 15 William St., New York 5, N. Y.

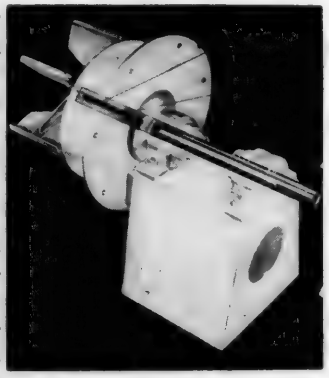
Central System Air Conditioners • Air-Cooled Condensers • Cooling Towers
Water-Cooled Condensers

AH SERIES
AIR HANDLER

HM
Halstead & Mitchell

High Temperature Fans

A unique air-cooled shaft which eliminates the need for water cooling, heat slingers, and other cooling devices, is an important design feature of the line of high temperature fans produced by Garden City Fan & Blower Co., Niles, Mich.



Designed to function effectively under conditions of high speed, pressure and temperature, the air-cooled shaft has an integral chamber-and-slot arrangement which substantially reduces transmission of heat. As the shaft rotates, air is evacuated from the internal chamber through four slotted orifices, creating a heat transfer barrier which keeps shaft cool at all vital bearing points. According to the company, this results in reduced maintenance and longer equipment life.

Made of nickel chromium stainless steel, the air-cooled shaft is furnished as standard equipment on the company's entire line of Thermal-Aire fans for operating temperatures up to 1700 deg F.

More Information? Circle Item 66 on Inquiry Card.

Space Filter Improved

Moisture resistance of Ultra-Aire space filter elements has been increased considerably through a new water-repellent filter medium announced by Mine Safety Appliances Co., Pittsburgh, Pa.

The advancement is expected to add considerably to service life of the filter by shedding water that clogs up air flow passages and limits the medium in strength.

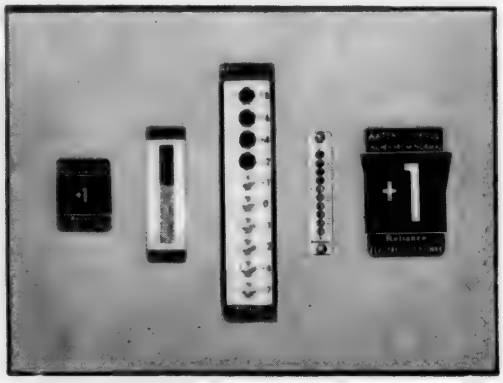
Originally developed by the U. S. Chemical Corps and the U. S. Atomic Energy Commission, this type of filter was designed to provide protection against air-borne radioactive particulate. It has now been greatly improved and adapted to a wide variety of applications in the pharmaceutical, photographic, optical, and other processing industries.

More Information? Circle Item 67 on Inquiry Card.

Electric Remote Water Gage

An electrically operated remote water level indicating system that needs no pressure-connections or compensating devices is introduced by The Reliance Gauge Column Co., Cleveland, Ohio.

Called Electro Eye-Hye, the system detects water level with electrodes in a direct-to-drum water column that is recommended by the manufacturer for service pressures up to 3,000 psi steam and 5,000 psi cold. All connections between the water column and the panel indicators are electric, permitting placement of single or repeater indicators at any distance without pressure connections.

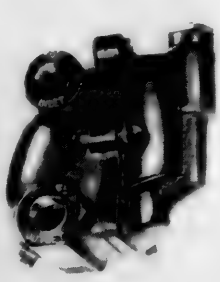


Five different indicators are available. Three are ten-light indicators which register liquid levels on a column of lights, providing 180 degree visibility. Two are digital readouts which project the liquid level—in inches above or below normal—onto a self-contained screen.

More Information? Circle Item 68 on Inquiry Card.

F & T Drip Traps

The V. D. Anderson Co., Cleveland, Ohio, announces the addition to its steam trap line of F & T drip traps for automatically draining condensate and venting air in lines up to two inches in size.



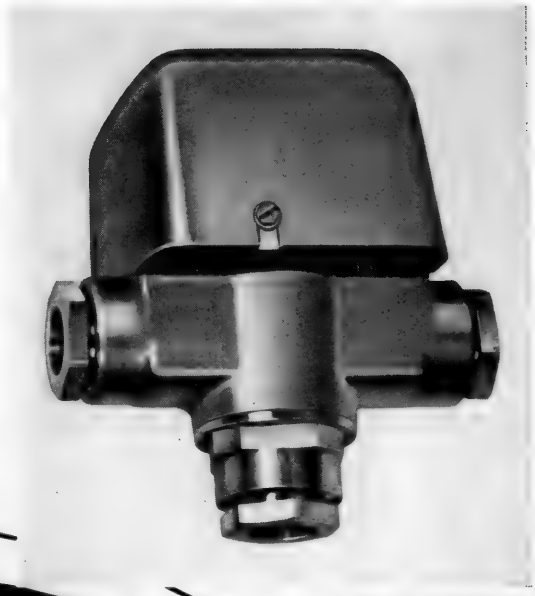
Principle use of this trap is heating and low pressure systems such as unit heaters, unit ventilators, return ends of blast coils, hot water heaters, steam main and riser drips and flash tanks.

Models are available with a choice of ¾ through 2-inch connections with maximum gage pressure of 15 lb. Traps can be supplied with the thermostatic air by-pass or without the thermostatic element and air by-pass for use where manual venting or external air by-pass is specified.

More Information? Circle Item 69 on Inquiry Card.

Now available * *for* **FAN-COIL UNITS**

Reliable, Quiet
MOTOR OPERATED VALVES

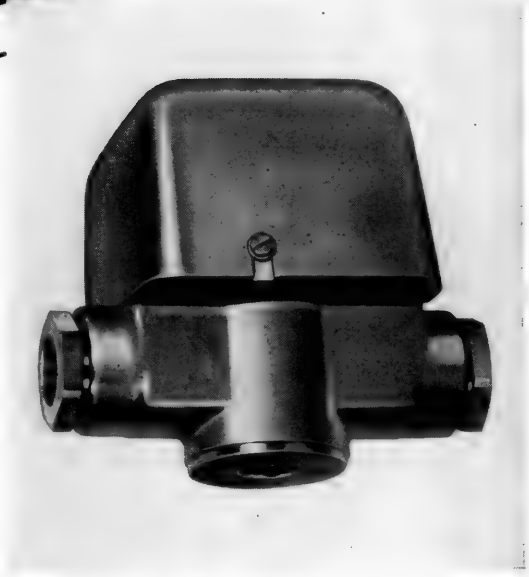


3-WAY MODEL

ERIE motortrol

SERIES 436A

2-WAY MODEL



- quiet operation
- low cost
- compact
- easiest installation
- works in any position
- high flow capacities
- simple design
- 100% shut-off
- "fail-safe" operation

* *WRITE FOR BULLETIN 210*

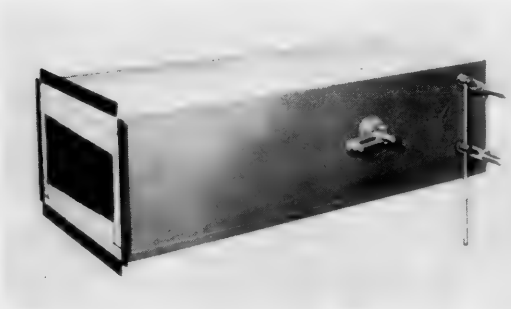
ERIE MANUFACTURING CO.

TRADE NAMES: MOTORTROL • ELECTROL • TIME-O-FLOW • TIME-O-GAS • PROGRAMMATIC • ELECTROMATIC

Milwaukee, Wisconsin and (Canada) Ltd., Stouffville, Ontario.

High-Velocity Mixing Unit

A single inlet mixing box has been developed by Air Distribution Div., Barber-Colman Co., Rockford, Ill., for use in interior zones that demand cooling the year around. Temperature control in the space is accomplished by providing more or less cooling, with a constant volume of air delivered at all times. On a thermostat demand for less cooling, the amount of cool primary air is reduced, and at the same time secondary air is induced into the primary air stream from a ceiling return plenum.



With the new unit, it is possible to reduce the amount of primary air, proportionately, as much as 50% and, at the same time, provide an equal increase in the volume of return air. Since warm return air from the ceiling plenum is used, this results in a cooling capacity reduction of more than 50%.

The ratio of secondary to primary air volume is adjusted by a single control motor positioned by a temperature sensing element in the controlled space.

More Information? Circle Item 70 on Inquiry Card.

Fiber Pipe Products

Two new fiber pipe products, said to trim downspout conductor and foundation drainage system job costs by 35% while increasing profits 50%, are introduced by Kyova Fiber Pipe Co., Ironton, Ohio.

Standard 10-ft lengths of perforated Kyova Drainage Pipe ($\frac{5}{16}$-inch holes for infiltration) and solid Kyova Downspout Conductor are available in 3, 4, 5 and 6-inch diameters. A complete line of fittings is also available to accommodate changes in direction.

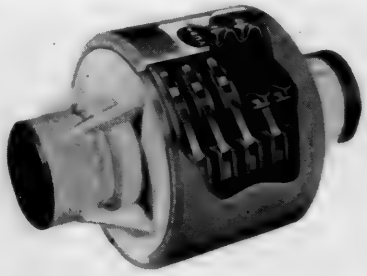
Joining compounds, gaskets, mortar and field tooling are eliminated completely, the firm reports. The only tools required for fast, sure installation are a handsaw, a hammer and a block of wood.

More Information? Circle Item 71 on Inquiry Card.

Bellows-Type Expansion Joint

A bellows-type expansion joint which is rigid against all movement except axial and which creates minimum friction along the guiding surfaces has been developed by Adsco Div., Yuba Consolidated Industries, Inc., Buffalo, N. Y.

Two models are offered: the Corruflex externally-guided model (illustrated) and the Corruflex expansion joint which is both internally- and externally-guided.

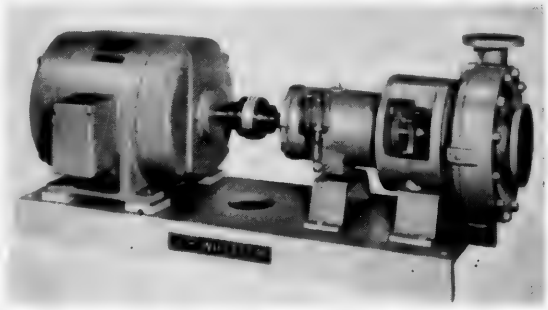


When internal or external, the guide is of heavy, dependable construction, welded strongly to the body of the expansion joint. In the internal application, a guide ring carefully welded to the inner slip rides smoothly, concentrically, and with little friction along the machined bore of the body to insure true axial movement. When the guide is external, the machined guide surfaces of the equalizing rings move smoothly and evenly in the bore of the external guide.

More Information? Circle Item 72 on Inquiry Card.

Line of All-Purpose Pumps

A new line of end suction centrifugal pumps, designed to meet service requirements of the heating, air conditioning and process industries, is introduced by C. H. Wheeler Manufacturing Co., Philadelphia, Pa.



The pumps, designated as type BHO, are engineered to handle various process liquids, either clear or carrying suspensions. According to the company, the outstanding features of these pumps are their liberal packing areas, heavy mechanical construction and external dimensions.

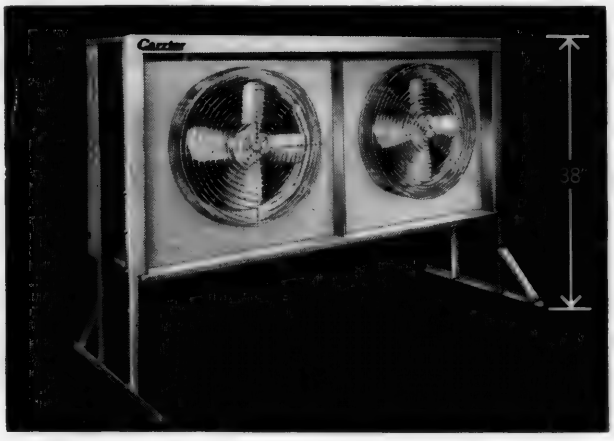
Classified as Series 300, the line offers 14 pump sizes, ranging from 1 to 5 inches. Pumps are capable of pumping liquids ranging in temperature from sub-zero to 350 deg F at pressures up to 250 psi.

More Information? Circle Item 73 on Inquiry Card.

NEW CARRIER AIR-COOLED CONDENSERS

CAPACITIES—from 3 tons!
EFFICIENCY—up!
SILHOUETTES—low!
MAINTENANCE—down!

MODEL 09DC presents an extremely low 33" silhouette—easily hidden by the typical parapet wall when installed on roofs. Air flow—and air flow noise—are directed upward and away from surroundings. Though designed for standard horizontal use, it adapts easily for vertical mounting.



MODEL 9AB with leg stand, an optional accessory. The 9AB may be roof-mounted with or without the stand. Even with the stand, it has a low 38" silhouette. By inverting the stand, the 9AB can be located in front of a window indoors—the whole unit suspended from the ceiling.

In keeping with Carrier's policy of constant product improvement, these two new air-cooled high-velocity condensers are even more efficient and economical in operation than previous models. They can be installed singly or in multiples to achieve low-cost performance requirements for most air conditioning and refrigeration applications.

The units consist of one or more direct-drive fans and a condensing coil. These powerful fans move large quantities of air evenly across the entire face of the coil to utilize full condenser capacity. For even greater efficiency, the copper-tube, aluminum-finned coil is engineered to create a better air wash, to lower air film resistance and step up heat transfer. Wider fin spacing prevents clogging by air-borne particles. The units are protected by a galvanized steel casing. Closely spaced, plated wire fan guards insure personal safety.

Although ordinarily installed on a roof, both these air-cooled condensers can be used wherever there is an adequate supply of outside air. For details, write Carrier Air Conditioning Company, Syracuse 1, New York. In Canada: Carrier Air Conditioning Ltd., Toronto 4.

Carrier ***Air Conditioning Company***

Water Treatment Systems

According to Culligan Inc., Northbrook, Ill., its new automatic feeder and Cul-Cleer water treatment systems provide commercial and industrial users with an effective and economical means of correcting almost any water conditioning problem.

The automatic feeder can be used to feed polyphosphates for scale prevention in almost any system where hard water is treated and forms scale. This includes water heaters, heating exchangers, evaporative condensers and cooling towers. Polyphosphates or silicates, or a combination of the two substances, may be fed to control corrosion and eliminate "red water." Alkaline substances may be added to neutralize acid water and also chlorine compounds to control organic growths.

When the automatic feeder is followed by a filter, as in the Cul-Cleer system, it is very effective in the removal of iron, manganese and hydrogen sulfide from water supplies. If turbidity or cloudiness is the problem the system can be used to clarify water by feeding a coagulant and filtering. Low initial and operating costs combined with exceptional versatility are reported for the system.

More Information? Circle Item 74 on Inquiry Card.

Hollow Structural Tubing

National Tube Div., U.S. Steel Corp., Pittsburgh, Pa., announces a complete new product line—a wide range of sizes of square and rectangular hot rolled carbon steel hollow structural tubing, made to structural steel specifications.

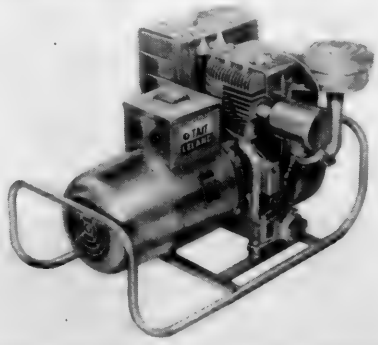
When the weightsaving factors of tubular sections are properly utilized, a building can be erected which is 30% to 40% lighter, but just as strong as the same structure employing conventional structural sections, and lighter framework can mean lighter footings and foundations. It can also mean reduced construction costs, lower freight charges, lower handling costs, and easier and faster field erection.

More Information? Circle Item 75 on Inquiry Card.

Portable Generating Plants

Electric generating plants, ranging from one to five kilowatts in capacity, are introduced by Tait Manufacturing Co., Dayton, Ohio, for portable use beyond the reach of power lines and for standby installations.

Models are compactly designed for easy portability, making them well-suited for use by contractors and utilities on-the-job. Other uses cover a wide range of farm, commercial, industrial, municipal, recreational, marine, and emergency disaster needs.



Powered by gasoline, Tait-Leland generators are built for heavy-duty performance and long life. The generator, 60 cycle a-c single phase, has a two-pole armature with inherent regulation and is self-excited and drip-proof. There is inherent voltage regulation with a change of approximately 10% or less.

More Information? Circle Item 76 on Inquiry Card.

Commercial Water Softeners

A new series of high capacity commercial softeners is offered by Modern Water Equipment Co., Freeport, Ill. These softeners, its commercial filter line and the commercial custom engineering service are reported to put the company in a position to fill all commercial water conditioning requests regardless of size.

The standard production units are available in two models with automatic or manual operation available in either. Two sizes are offered for each model.

More Information? Circle Item 77 on Inquiry Card.

Registers, Grilles and Diffusers

A new line of registers, grilles and curved blade diffusers, featuring extruded, anodized aluminum frames combined with all-nylon moving parts, blades and damper mechanisms, is announced by Air Guide Corp., Miami, Fla.

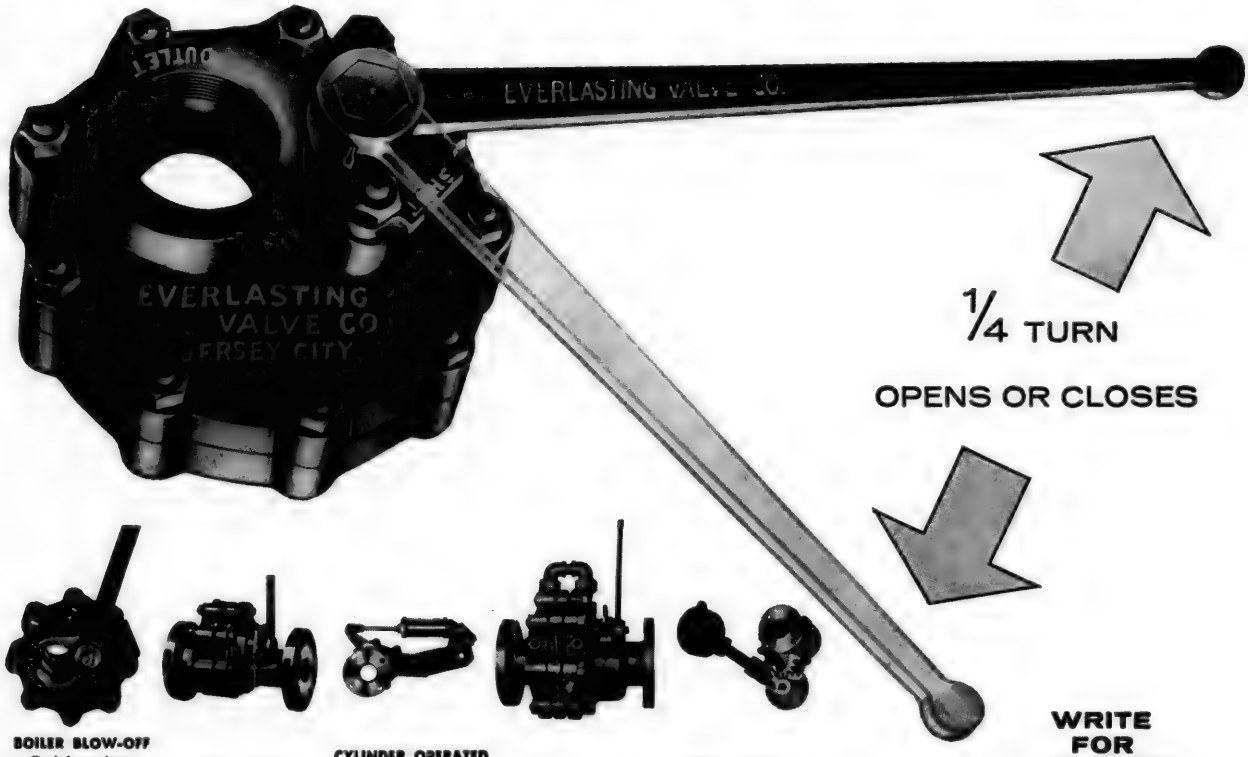
In combining aluminum frames with nylon parts, the manufacturer provides what is called the perfect "marriage" of materials, with a total of features offering all the advantages of rigid frames, plus the permanent "self-lubricating" features of moving nylon parts which can never rust, bind or jam up in use. A 20-year replacement guarantee is offered by the company.

More Information? Circle Item 78 on Inquiry Card.

(Continued on page 125)

When you need fast, easy opening and closing with a leak-proof seal and straight-through flow with minimum pressure drop specify

EVERLASTING



BOILER BLOW-OFF
Quick acting, also handwheel operated "Y" and angle types. For pressures up to 600 psi.

GENERAL SERVICE
Where drop-tight seal and full flow is essential.

CYLINDER OPERATED
Can be remotely controlled, electrically or manually.

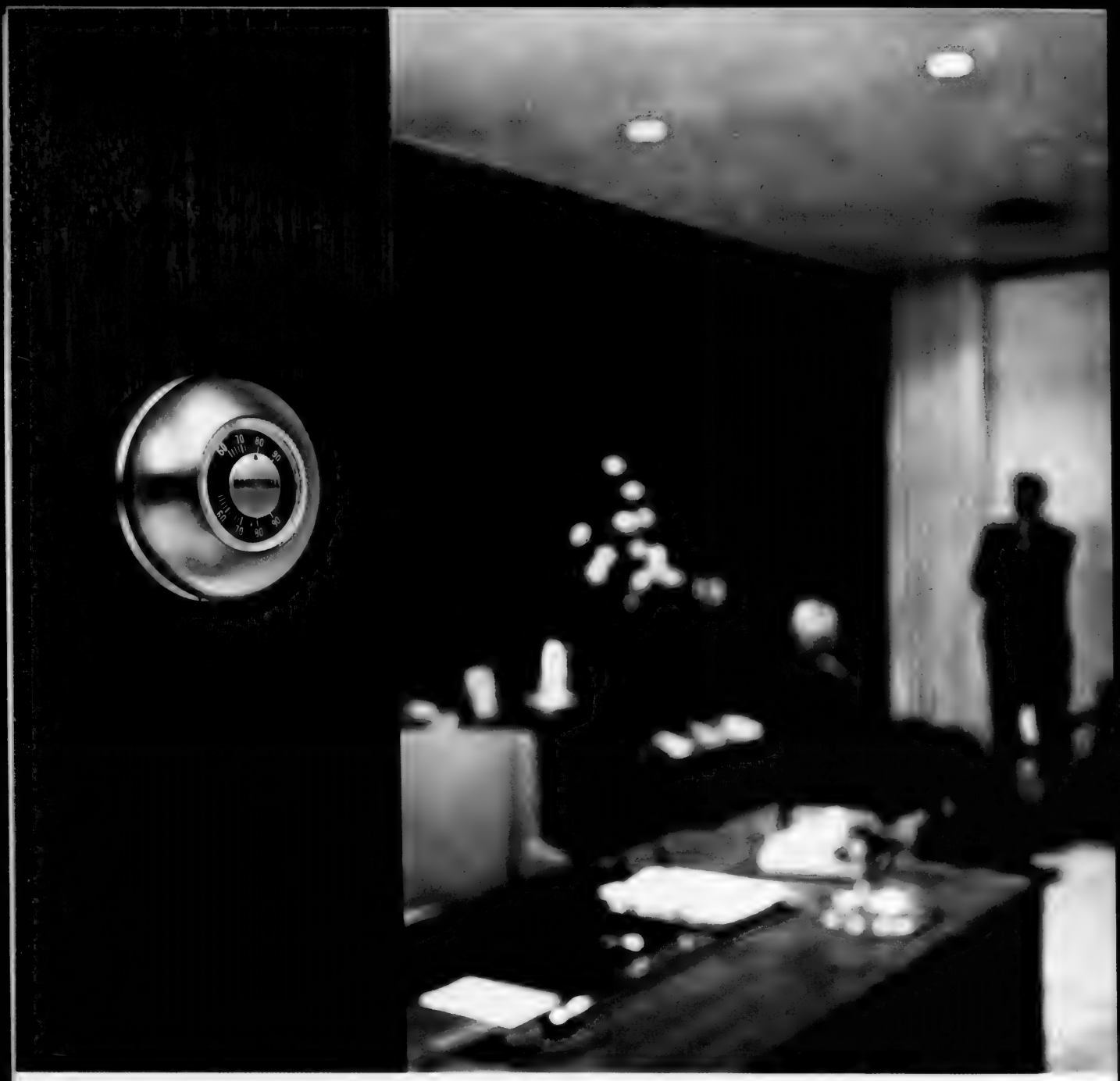
STEAM JACKETED
Assures free flow of viscous materials.

WEIGHT-OPERATED
For automatic drains or emergency shut off.

WRITE FOR BULLETIN

EV-409

EVERLASTING VALVE COMPANY, 75 FISK STREET, JERSEY CITY 5, N. J.



The Honeywell Thermostat

MECHANICALLY NEW INSIDE...BEAUTIFULLY NEW OUTSIDE

FEWER WORKING PARTS

LOW-MASS SENSING ELEMENT

9 NEW FINISHES

Now offer your customers more accurate, more sensitive and more colorful temperature control.

Honeywell's simplified construction protects critical working parts in the base. A low-mass sensing element provides immediate response to temperature changes. The heavy gauge steel cover stands up to the toughest abuse. Seven finishes are electro-plated for lasting beauty—highly impervious to scratches and smudging. Two finishes are tough, baked-on enamel.

The new Honeywell Round is easier to read and set, too, with white numerals on a black background. With its new finishes, you and your architect can offer clients a wider choice—at no increase in cost!

Install Honeywell controls to assure your customers of the finest, smoothest heating and cooling.

Be sure you tear out the color chart on the next page to help you sell your prospects. For assistance on your next job, contact the Honeywell representative in your territory. ***Sales and service offices in all principal cities of the world.***

TEAR OFF AND SAVE!

LOOK AT ALL THE FINISHES YOU CAN OFFER!

SATIN CHROME. A brushed chromium plated surface. This finish supplied if no other specified.

POLISHED NICKEL. A bright, plated surface with a little softer tone than the polished chrome.

POLISHED CHROME. A bright chromium-plated surface, ideal for hospitals and other institutions.

SILVER BRONZE. A brushed silvery-bronze baked enamel surface with diamond luster coating.

STATUARY BRONZE. A rich, darker brushed bronze tone, plated. Heavy gauge steel cover resists abuse.

BOWER BARFF BLACK. A soft, black painted surface that adds a unique decorating touch.

BRUSHED BRASS. A soft, brushed golden brass color. Electro-plating keeps appearance years longer.

POLISHED BRASS. A gleaming golden-brass tone, plated. Virtually scratch-proof, smudges wipe off easily.

SATIN NICKEL. A brushed plated surface that is neutral in tone. All finishes resistant to corrosive atmospheres.

ONLY HONEYWELL DESIGNS, MANUFACTURES AND INSTALLS ALL THREE KINDS OF TEMPERATURE CONTROL—pneumatic, electronic and electric

Honeywell

First in Control

SINCE 1885

Designed for Architects • Engineers • Contractors

Whatever the architectural specifications, the slim-trim distinctive design of Stripline extruded aluminum slot-type diffusers blends in perfectly with the general decor. Stripline with separate mounting frames and interchangeable cores eliminates screwholes, leaves the decorative surface unmarred.

Stripline is INCONSPICUOUS . . . PRACTICAL, can be located anywhere to suit the interior designer's preference...in walls...ceilings...coves...moulds... window sills. Stripline is supplied as a continuous decorative unit, or in sections, to meet any requirements of interior treatment or airflow.

Unlike side wall grilles and air discharge slots, Stripline diffusers incorporate the exclusive Agitair diffusing vanes. These built-in diffusing vanes produce extremely high turbulence and aspiration... achieve rapid temperature equalization...insure the distribution of tempered air unvaried over a predetermined area without any noticeable air motion.

In the design of Stripline extrusions, top priority was given to solving the contractors installation problems. These units are now made with interchangeable cores and separate mounting frames for surface or plaster installations. An integral part of each diffusing core is the unique coil spring-lock which further facilitates the installation of Stripline when used as a continuous unit or where sections are required. This spring-lock feature locks the unit firmly in place, and eliminates the use of screwholes and screws.

For more information write for
technical catalog ES-105

AIR DEVICES INC.

185 MADISON AVENUE • NEW YORK 16, N.Y.

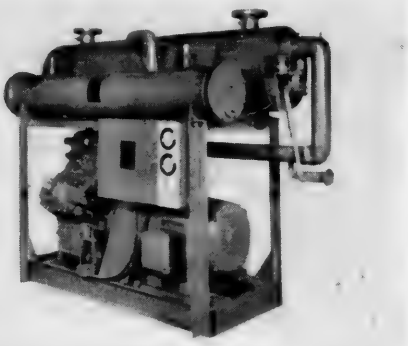
BETTER PRODUCTS FOR
AIR DISTRIBUTION • AIR CLEANING • AIR EXHAUST

(Continued from page 120)

Packaged Liquid Chillers

York Corporation, York, Pa., subsidiary of Borg-Warner Corp., announces a new line of packaged liquid chilling machines. Called the 3DD Series, these chillers are of the direct expansion type and are available in 50, 60, 70, 100 and 125-ton sizes.

Called extremely compact for their capacities, these models are available with the company's "load minder" that permits continuous, stable operation of the unit even when the load is 10% of peak efficiency.



In addition, they are shipped from the factory fully wired and piped, and have been performance tested.

Installation is easy since no bolting to the floor is required. These chillers are equipped with vibration isolator floor mounts and need only be placed on a level surface. Models are also available less condenser for remote water or air cooled condensing.

More Information? Circle Item 79 on Inquiry Card.

Large Capacity Submersibles

Berkeley Pump Co., Berkeley, Calif., further expands its line of 4-inch submersibles with the addition of two new models; the 4DL 14-gpm series and the 4DM 18-gpm series. The capacity provided by these two models is more than adequate for large domestic water systems and will find many applications for commercial water supply. Settings may be as deep as 700 ft with full 40 lb cutoff pressure. Horsepower will range from ⅓ through 5 with all intermediate sizes.

Impellers are injection molded nylon keyed to a stainless steel shaft. Bowl diffusers are of high impact polystyrene plastic encased in bronze outer shell. These materials, according to the company, have superior wearing qualities and their inherent smooth surfaces account for higher efficiencies.

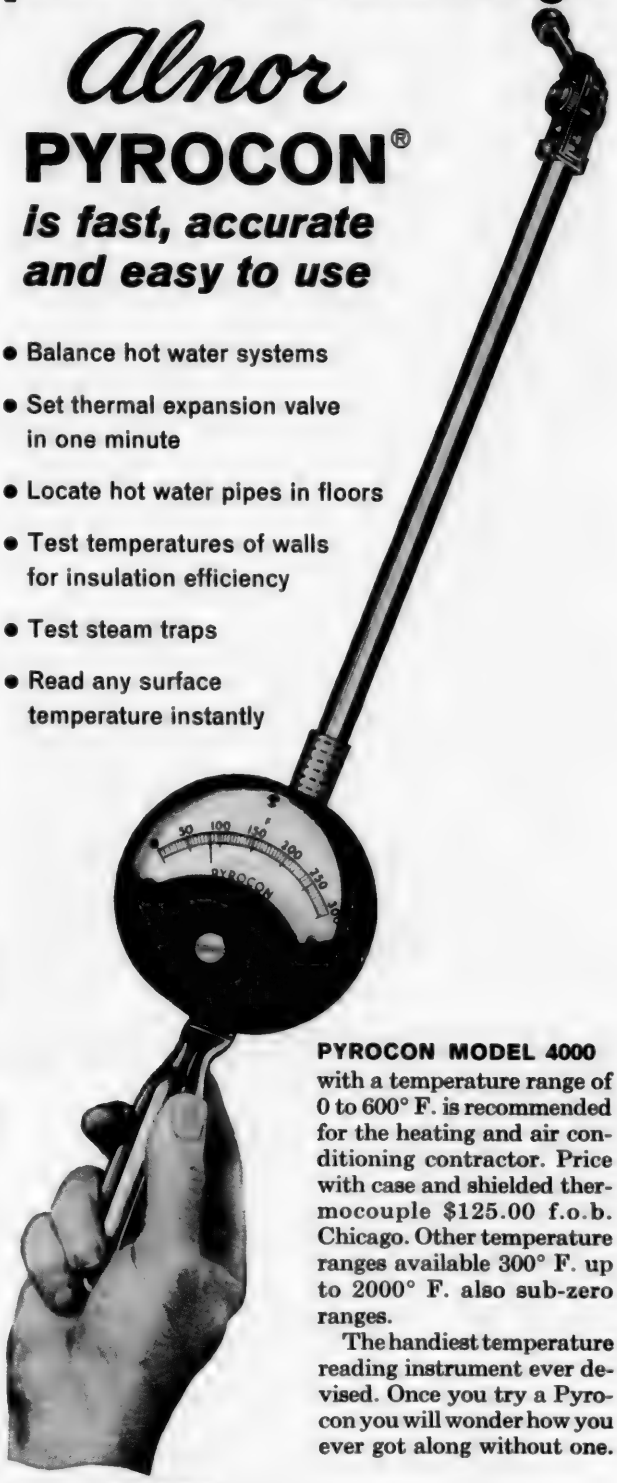
More Information? Circle Item 80 on Inquiry Card.

(Continued on next page)

For Surface Temperature Readings

Alnor
PYROCON®
is fast, accurate and easy to use

- Balance hot water systems
- Set thermal expansion valve in one minute
- Locate hot water pipes in floors
- Test temperatures of walls for insulation efficiency
- Test steam traps
- Read any surface temperature instantly



PYROCON MODEL 4000 with a temperature range of 0 to 600° F. is recommended for the heating and air conditioning contractor. Price with case and shielded thermocouple $125.00 f.o.b. Chicago. Other temperature ranges available 300° F. up to 2000° F. also sub-zero ranges.

The handiest temperature reading instrument ever devised. Once you try a Pyrocon you will wonder how you ever got along without one.

Alnor INSTRUMENTS

ALNOR INSTRUMENT CO.
Division of
Illinois Testing Laboratories, Inc.
Room 570, 420 N. La Salle St., Chicago 10, Ill.

Oil Preheaters

Lindy Hydrothermal Products, Inc., New York, N.Y., announces a new safety-type oil preheater for residential and commercial boiler applications.

These preheaters feature an easily removable and replaceable tube-within-a-tube coil bundle, a sight glass which warns of oil leaks before damage is done to the boiler, and other advantages.

Complete protection against oil entering the boiler system is provided by the tube-within-a-tube coil construction. The space between the tubes is filled with an intermediate heat transfer and monitoring fluid. If either tube should begin to leak, the boiler is protected by the second tube, but the monitoring fluid will immediately discolor, indicating in the sight glass that the bundle should be changed.

More Information? Circle Item 81 on Inquiry Card.

Air Cleaners for White Rooms

For industrial, commercial and medical "white room" applications, where clean atmospheres are a critical requirement for process and personnel, Research-Cottrell, Inc., Bound Brook, N.J., has developed electrostatic air cleaners that can remove dust particles or air pollutants with guaranteed efficiencies in excess of 99%.

These air cleaners can be custom-designed for a wide range of commercial and industrial applications which, besides "white rooms," include underground power and control rooms, medical and hospital facilities, underwater and high-altitude transport.

Research-Cottrell air cleaners of both plate and tube type in capacities from 100 to 11,000 cfm have been produced and proven to comply with stringent government specifications.

More Information? Circle Item 82 on Inquiry Card.

Cooling Treatment Line

A new line of cooling water treatment products, designed specifically to meet the needs of medium and small sized air-conditioning installations, is announced by Dearborn Chemical Co., Chicago, Ill. Four of these, all in briquette form and all providing virtually fool-proof feeding and control, will go on sale immediately through Dearborn's regular sales force and through franchised engineers to be set up throughout the country.

More Information? Circle Item 83 on Inquiry Card.

Crown Furniture • Clawson, Michigan

12% saved on installation—7% saved in construction costs

(BASED ON 10,000 SQ. FT. BUILDING)

VENTIL-AIRE®

Packaged Roof-Mount Air-Conditioning and Heating System

For single story commercial and industrial buildings.

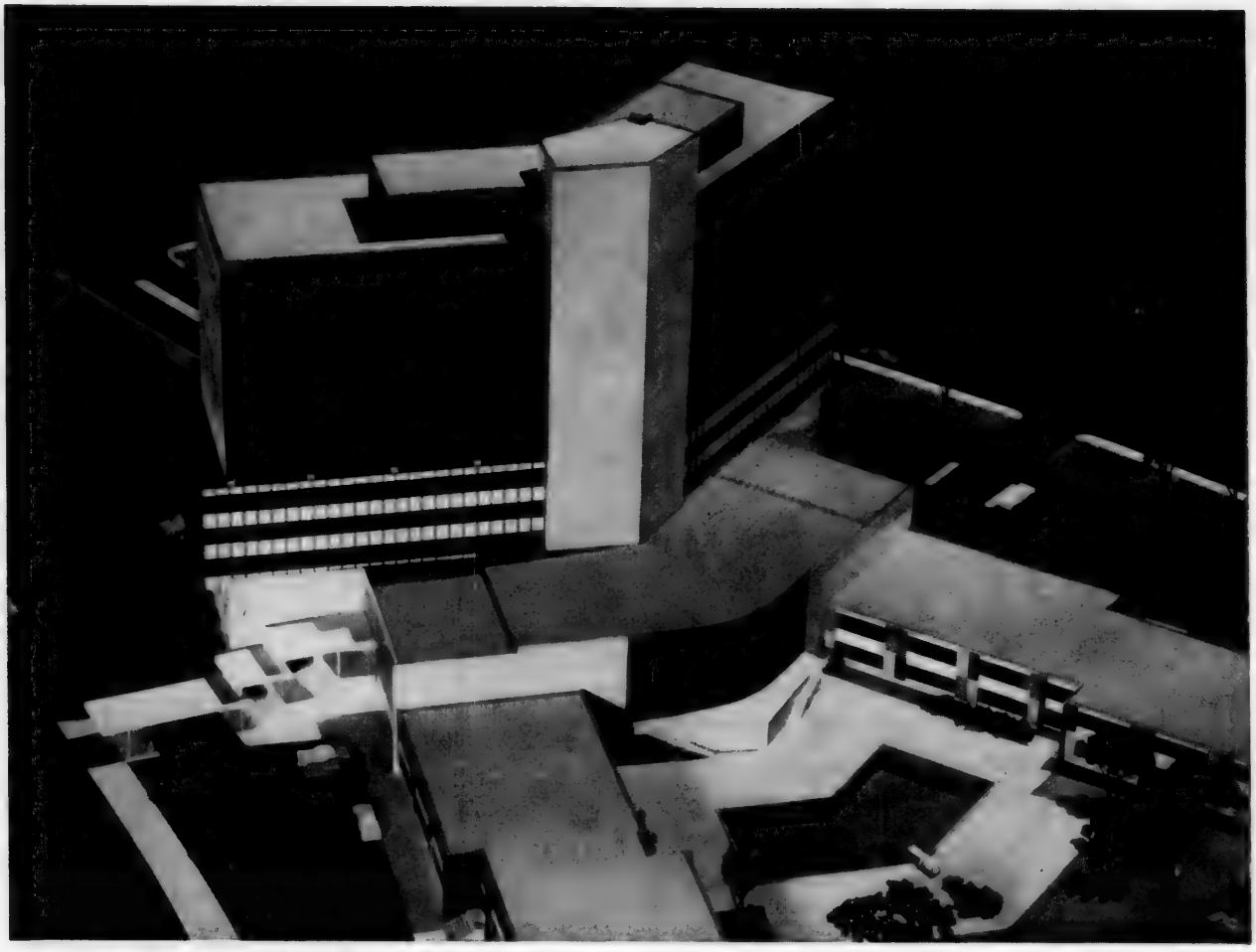
Ventil-Aire's air-conditioning and heating system combines all the elements of built-up systems into one compact package. Air-conditioner, air cooled condensing unit, compressor and gas or oil fired heater are combined in this single operating unit. The unit is delivered ready for installation—requiring cutting small opening through roof, connecting short duct to ceiling diffuser which is supplied and the hook-up of electrical and fuel lines.

The system saves valuable floor space, money in initial cost, installation and maintenance, and delivers more cooling or heating per dollar of operation. Here is air-conditioning and heating at its best for small and large installations. **Available in 5, 7½, 10, 15, 17½ and 20 ton sizes.**

Write for illustrated literature and case histories.

VENTIL-AIRE CORPORATION

1815 Decatur St. • Brooklyn 27, N. Y.



GOLDEN TRIANGLE MOTOR HOTEL, Norfolk, Virginia. Architect: Anthony F. Musolino; General Contractor: Blake Construction Company; Mechanical Contractor: Hicks & Ingle Company; Distributor for Anaconda: Hajoca Corp.

6 miles of Anaconda Copper Tube (½" to 5") installed "easier and quicker"

This recently completed, six-million-dollar development in downtown Norfolk contains more than 32,000 feet of Anaconda Copper Tube in sizes from ½" through 5" for hot and cold water lines. *Why Anaconda Copper Tube?* Howard C. Robinette, Division Manager for Hicks & Ingle, says, "We used Anaconda Copper Tube because of the ease in handling and quicker installation. We found it very advantageous in confined areas . . ."

Add to these cost-saving installation advantages, *longer life* and *less maintenance* and you have the reasons why Anaconda Copper Tube is so often the choice of those who demand quality in plumbing materials. For complete information about Copper Tube and Fittings for general plumbing, heating, air conditioning and refrigeration, write for free copy of Publication B-1, Anaconda American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ontario.

61-728

Making connections in tight places is no problem with Copper Tube and Solder-Joint Fittings.

ANACONDA®

COPPER TUBE AND FITTINGS

PRODUCTS OF ANACONDA AMERICAN BRASS COMPANY

Available through plumbing wholesalers

BRIEFLY STATED NEWS ITEMS

D. A. Bohlen & Son and Burns & Burns announce the consolidation of offices for the practice of architecture under the name of BOHLEN & BURNS, ARCHITECTS AND ENGINEERS, at 1308 North Meridian St., Indianapolis 2, Ind. . . .

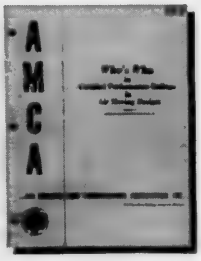
The office of COWELL & ROBINSON, ARCHITECTS-ENGINEERS, announce the removal of their New York office and drafting rooms to larger quarters at 350 Madison Avenue—Penthouse, New York 17, N.Y., and a change in firm name to COWELL & RADENHAUSEN, ARCHITECTS-ENGINEERS. . . .

KEMP, BUNCH & JACKSON, ARCHITECTS announce the new location of their offices at 1320 Coast Line Bldg., Jacksonville 2, Fla. . . .

Who's Who in Certified Ratings?

The first edition of "Who's Who in Certified Performance Ratings" is now available to users and specifiers of air moving equipment. This new publication of the Air Moving and Conditioning Association meets the recognized need for an official directory of manufacturers and products licensed by AMCA to use the Certified Ratings Seal.

The 54-page directory contains essential product identification data on all air moving devices which have been tested and rated for performance in accordance with the rigid requirements of the AMCA Certified Ratings Program. Revised issues will be published periodically.



Copies of Bulletin 261A, "Who's Who in Certified Performance Ratings" are available from: Air Moving and Conditioning Association, Inc., 2159 Guardian Building, Detroit 26, Michigan.

The new address of HENNINGSON, DURHAM & RICHARDSON, ENGINEERS, ARCHITECTS, AND PLANNERS, is 3555 Farnam St., Omaha 31, Neb.

WITH THE ENGINEERS

Establishment of a new firm—CONSTRUCTION PRODUCTS RESEARCH, INC.—to provide research, analysis and consulting services to manufacturers and marketers of building products, components, and materials, has been announced by H. Nash Babcock, president of The Nash Babcock Engineering Company, Old Greenwich, Conn. Headed by Mr. Babcock, the new firm is staffed by engineering specialists with a range and depth of experience in general contracting and construction, as well as in mechanical, electrical, structural and design fields. . . .

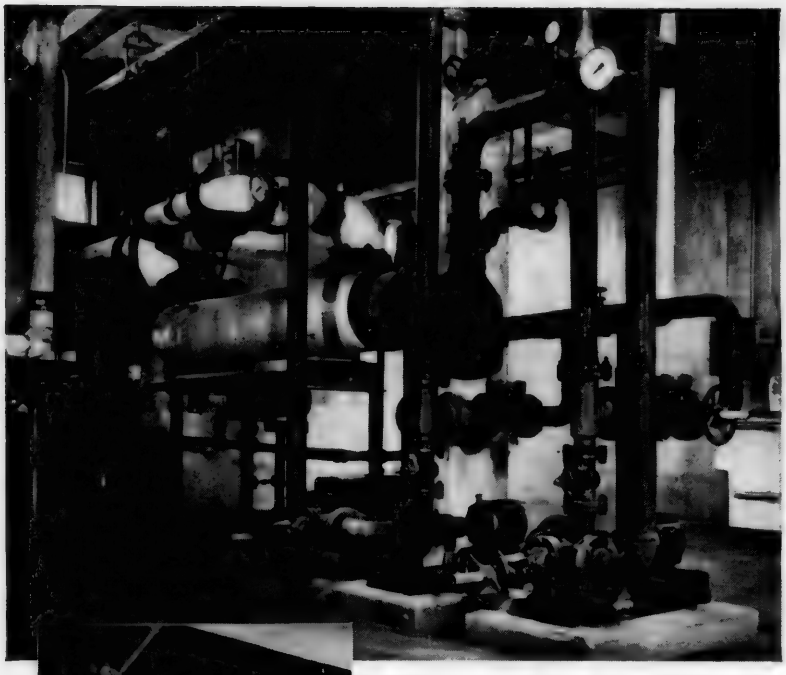
Herbert Z. Ziel, Associate in charge of Air Conditioning and Ventilating for ALBERT KAHN ASSOCIATED ARCHITECTS AND ENGINEERS, INC., was elected chairman of the Air Conditioning in Industry Committee of the American Society of Heating, Refrigerating and Air Conditioning Engineers at their recent national convention in Denver, Colorado. Long active in ASHRAE affairs, Mr. Ziel has served on numerous committees for the 18,000 member Society including the Industrial Environment Board and the Psychometric Chart Committee. The Air Conditioning in Industry Committee functions as a review board to pass on all air conditioning research projects contemplated by the Society and to approve all papers offered for publication in the ASHRAE Journal. . . .

Harold Grasse has joined HENNINGSON, DURHAM & RICHARDSON as head of the Mechanical Engineering department of the architectural and engineering firm, according to an announcement by C. W. Durham, president. Mr. Grasse had been associated with the consulting engineering firm of Black & Veatch, Kansas City, for 22

(Continued on page 130)

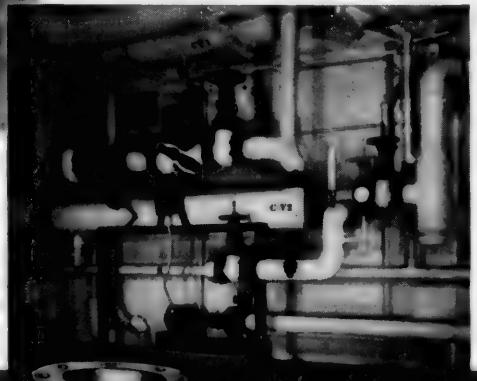
FOR ECONOMICALLY HEATING WATER WITH STEAM

TYPE "SU" HEAT EXCHANGER



▲ Type "SU" Heat Exchanger used to heat convectors for faculty rooms, Loyola Academy, Chicago

◀ "SU" installed to heat swimming pool shower water, Loyola Academy



▶ This "SU" is used to furnish supplemental heat to a warehouse and shipping room area at Avon Products Inc., Morton Grove, Ill.

B&G Type "SU" Instantaneous Heat Exchangers are designed to heat water or other liquids with steam and can be connected to any steam boiler or system.

An "SU" provides an efficient low cost method of heating water for apartment buildings, hotels, hospitals, schools, industrial and processing plants. Comparatively small units produce large volumes of hot water—no storage tank needed.

In buildings where steam is required for process use, the advantages of a forced hot water system can be obtained by installing an "SU" Heat Exchanger instead of an extra boiler. These heaters also have many applications in vertically zoning large hot water heating installations to avoid high static heads.

With each B&G "SU" Exchanger, a Manufacturer's Data report for Unfired Pressure Vessels, Form No. U-1 as required by the A.S.M.E. Code rules, is furnished. This form is signed by a qualified inspector, holding a National Board Commission, certifying that construction conforms to the latest A.S.M.E Code for unfired pressure vessels. The A.S.M.E. "U" symbol is stamped on each exchanger.

For complete information send for "SU" Catalogs No. SC-159 and SI-159.

SPECIAL FEATURE

"INSULATED TILT-UP CONSTRUCTION"

STARRING

LAYKOLD INSULATION ADHESIVE

When builders applied the tilt-up technique to refrigerated warehouse construction, Laykold Insulation Adhesive was a "natural", adhering the vapor barrier membrane to the concrete wall panels. It also helps hold the glass-fiber blanket insulation.

Here's the way a tilt-up job goes:

1. Pour wall panel on floor and let set
2. Spray on Insulation Adhesive at 23 sq.ft./gal. It helps cure the concrete.
3. Press the vapor barrier membrane into the set Adhesive.
4. Tilt the panel up into position and anchor.
5. Spray Insulation Adhesive over membrane at 23 sq. ft./gal.
6. Press blanket-type insulation into place.

The speed and ease of this operation underscores the major advantages of Laykold Insulation Adhesive: *Spray-applied . . . cold . . . it saves time, equipment, money!*

Now Available:
a 15-minute, color-and-sound, 16mm motion picture of a tilt-up job. Ideal for employee groups or association meetings. Write for details. No charge, no obligation.

American Bitumuls & Asphalt Company

320 MARKET, SAN FRANCISCO 20, CALIF.
Perth Amboy, N. J.
Baltimore 3, Md.
Cincinnati 38, Ohio
Atlanta 8, Ga.
Mobile, Ala.
St. Louis 17, Mo.
Tucson, Ariz.
Portland 8, Ore.
Oakland 1, Calif.
Inglewood, Calif.
San Juan 23, P. R.

BITUMULS® Emulsified Asphalts • CHEVRON® Paving Asphalts • LAYKOLD® Asphalt Specialties • PETROLASTIC® Industrial Asphalts

years, and was a partner and principal engineer for six years. He will headquarter in Omaha, specialize in design of steam power plants and work with all five offices of the firm. . . .

Abraham Benjamin, P. E., has been appointed manager of the newly-established Special Projects Division of the Montreal, Que. consulting engineering firm of SURVEYER, NENNIGER & CHENEVERT. The Special Projects Division has been formed specifically to serve architects and other clients with complete consulting engineering services for commercial, institutional and manufacturing building projects. Mr. Benjamin is a graduate of McGill University, where he obtained a BSEE in 1924. He brings to his new position extensive experience in the commercial and institutional engineering fields. . . .

William F. Lange has been named chief engineer of the Products Division of TODD SHIPYARDS CORPORATION, New York, N.Y. Mr. Lange will report to Mr. William H. Bohn, General Manager of the Products Division in Brooklyn. This appointment coincides with the Products Division's stepped-up engineering activities and the recent acquisition of the sales and manufacturing rights to the Carrier Heat Diffuser. . . .

The architectural-engineering firm of ADRIAN WILSON AND ASSOCIATES, Los Angeles, Calif., has been awarded a Certificate of Appreciation by the Director, Pacific Division, Bureau of Yards and Docks. The citation is for exemplary services rendered the U. S. Navy, the Air Force and the Republic of the Philippines in connection with architectural and engineering construction contract performance. The Manila office of Adrian Wilson and Associates is responsible for the honor bestowed by reason of their expeditious handling of work and their performance in meeting emergency schedules. Their continuous research into suitable local materials and recommendations regarding usage has

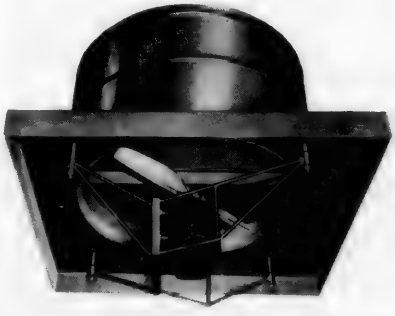
been a boon to accomplishing construction criteria under adverse conditions.

ASSOCIATIONS

The consultant's private enterprise banner will have a strong standard-bearer next November when the CONSULTING ENGINEERS COUNCIL convenes its regular Semi-Annual Meeting. He is Richard Wagner, president of the Chamber of Commerce of the United States, just announced as the featured speaker at CEC's convention banquet to be held November 3, at the Golden Gate Hotel, in Miami Beach. Mr. Wagner's address will conclude more than three days of meetings, which will be attended by at least 200 CEC delegates and guests. Among the more important subjects slated for coverage during the November Consulting Engineers Council conclave are: The consultant's role in private enterprise, corporate practice for private engineering firms, division of responsibility between architects and engineers, introduction of new standard "Mechanical-Electrical Special Conditions," and standard accounting forms for use in private practice. Committee reports on such matters as professional liability insurance, "free" engineering, manufacturers' catalog indexing system, fees schedules, "moonlighting," and engineer-contractor relations, will also be presented. . . .

The National Association of Domestic and Farm Pump Manufacturers met June 15 and 16 to begin activating a sweeping reorganization plan. The first step in the process of streamlining and modernizing: a new and less cumbersome name for the Association. The members promptly chose WATER SYSTEMS COUNCIL and then voted to make it official. The Council members further voted to broaden the Association's base of operations by opening membership to suppliers on an associate company membership basis. It is the hope and intention of the Council that in so doing, manufacturers and suppliers

prescribe
HARTZELL ROOF VENTILATORS
for efficient, economical
exhaust of heat, smoke and fumes



You will find Hartzell Roof Ventilators wherever industry has need for a high efficiency ventilator which will operate year after year with a minimum of maintenance. Vertical discharge types such as the Hartzell Vertijet (shown at left) are simple, fool-proof, easy to install and economical to operate. Other types are also available, including a unique reversible ventilator which can be used for exhaust or intake at the flip of a switch.

For complete details, just give your nearby Hartzell fixed engineer a call. You'll find him listed in the Yellow Pages or in the Hartzell catalog in Sweet's Plant Engineering and Industrial Construction Files.

Hartzell PROPELLER FAN COMPANY
Division of Castle Hills Corp. • PIQUA, OHIO
(HARTZELL)
A Member of AMCA

This WHEEL

MAKES LEHIGH I. E. INDUSTRIAL FANS IDEAL FOR TOUGH INDUSTRIAL EXHAUST APPLICATIONS

Handles dust-laden air and gases, paper shavings and the like without clogging

Lehigh Industrial I.E. Fans . . . featuring heavy duty, unique channel construction, all-welded mild steel wheels of the long shaving design . . . solve difficult exhaust problems because of their non-clogging characteristics. They incorporate a universal housing, which permits rotation and discharge to be modified to facilitate variable field conditions.

A complete range of sizes is available in both 70° to 250°F and 251° to 600°F construction. All standard drive arrangements are available and will be furnished according to your specifications.

Rugged, air-tight construction: the fan housing is welded on the inside with a continuous fillet weld. This provides gas-and air-tight housing with joints of maximum strength.

Standard, self-aligning ball-bearing pillow blocks . . . grease lubricated . . . are featured on all Lehigh Industrial I.E. Fans.

Optional accessories include an inspection door, inlet and outlet flange, heavy duty housing construction, and drain plug.

Get detailed information on how Lehigh I.E. Industrial Fans can solve your industrial exhaust problems with dependable non-clogging performance. Your Lehigh Representative will be happy to supply you with full details. Or, if you choose, write directly to us for Bulletin L-5:

2172
LF-2

LEHIGH FAN & BLOWER DIVISION
FULLER COMPANY, CATASAUQUA 5, PA.
Subsidiary of General American Transportation Corporation

LEHIGH

"See Chemical Engineering Catalog for further details and specifications."

can work jointly on the development of promotion of quality water needs for the consumer. R. W. Lewis, Fairbanks, Morse & Co., president of the Water Systems Council, added that the association has established a streamlined executive committee, composed of the president and the two vice presidents. Several weeks prior to the meeting the Board of Directors announced the selection of Richard G. Breeden, R. G. Breeden & Associates, an association management firm, to serve as executive secretary of the Council. . . .

G. Allen Briggs, plumbing-heating-cooling contractor of Oak Park, Mich., was elected president of the NATIONAL ASSOCIATION OF PLUMBING CONTRACTORS for the 1961-62 fiscal year at the concluding session of the 79th annual convention June 22, in the Ball Room of the Sheraton-Cadillac Hotel, Detroit. He had served as vice president of NAPC for the twelve months past. Delegates then ratified Mr. Briggs' choice of W. Wilbur White, plumbing-heating-cooling contractor of Detroit as his secretary for the new administration. Mr. White has been president of the Michigan Association of Plumbing Contractors the past year.

BURGEONING BUSINESS

THE VILTER MANUFACTURING CORPORATION has announced the further expansion of its sales force with the opening of a new office in Cleveland, Ohio and the appointment of George E. Brenton as its regional manager. From this office, he will direct the sale of refrigeration and air conditioning equipment throughout the northern half of Ohio and eastern Michigan. . . .

THE FLINTKOTE COMPANY plans to start construction this summer of a $10,000,000 asbestos-cement pipe plant in Ravenna, Ohio, 15 miles west of Akron. Signaling Flintkote's entry into this field, the plant is the first of two planned by the company as a result of a licensing agreement between it and the Johns-Manville Corporation. Under

this agreement, Flintkote was licensed by J-M to make asbestos-cement pipe long marketed by J-M under the trade name *Transite.* Products made by Flintkote will be merchandised through its Orangeburg Manufacturing Division. . . .

Formation of a new General Electric product section, the Central Air Conditioner Section, comprised of G-E's Tyler, Tex., central air conditioner plant and their Trenton, N.J., furnace plant, was announced. Heading the new section is W. J. McCullough, formerly manager of finance for G-E's Air Conditioning Department in Louisville. As general manager, Mr. McCullough will have responsibility for both the Tyler and Trenton operations. . . .

Dynamics Corporation of America announced that its ANEMOSTAT CORPORATION subsidiary will move into a modern, 165,000 sq ft "expandable" plant at Scranton, Pa. this summer. Expected to be in production by October 1, with employment of approximately 300, the single-story plant will bring together, under one roof, Anemostat research, development and production programs, permitting a continuous flow, from drawing board to final assembly, of air conditioning, heating, and ventilating equipment for commercial and industrial buildings. Present Anemostat production is spread out over ten floors in two buildings in Hartford, Conn. Election of Cartis T. Roff as president of Anemostat was announced by DCA President R. F. Kelley. Mr. Roff had been Anemostat vice-president in charge of production and engineering since November, 1959. . . .

ALLIED CHEMICAL'S GENERAL CHEMICAL DIVISION announced production of "Genetron" fluorinated hydrocarbon refrigerants and aerosol propellants from a new multi-million dollar plant located at its Elizabeth, N.J., Works. With a capacity well in excess of 10,000 tons per year, this plant marks General Chemical's third "Genetron" producing facility. . . .

INCREASE EFFICIENCY AND DECREASE COSTS WITH METROPOLITAN MAINTENANCE PRODUCTS

DUBOTH®
BOILER FEED WATER TREATMENTS
VAPORENE®
AIR CONDITIONING WATER TREATMENTS
SLUDGOUT®
FUEL OIL ADDITIVE FORMULATIONS
SOOTRACIDE®
SOOT AND SLAG ELIMINATOR
EZ TREAT®
COMPLETE TREATMENT FOR SMALL AIR CONDITIONING
DESCALER®
AIR CONDITIONING AND BOILER SCALE REMOVERS
CORRODINE®
STEAM & RETURN LINE TREATMENT
CORRODICIDE®
TREATMENT FOR GENERAL WATER SUPPLY SYSTEMS

As They Have For 40 Years, Engineers Everywhere Today Rely On METROPOLITAN'S Quality Chemical Maintenance Products And Consulting Services.

Through Scientific Field Surveys And Laboratory Analyses METROPOLITAN Works Closely With You To Find The Right Answers To Your Specific Problems.

To Prevent Or Eliminate Problems Of Scale, Corrosion, Slime, Soot, Slag, Sludge Caused By Impurities In Water And Fuels . . . In Boilers, Cooling Towers, Evaporative Condensers, Storage Tanks, Steam & Return Lines, General Water Supply Systems . . . In Industrial Plants, Office Buildings, Apartment Houses, Public Institutions, Hotels, Theaters, Stores . . .

ASK FOR THE MAN FROM METROPOLITAN. HE HAS THE CHEMICAL SOLUTION FOR YOU.

See our Representative in your area or write us for complete information.

METROPOLITAN REFINING CO., INC.
50-23 TWENTY-THIRD STREET
LONG ISLAND CITY 1, N.Y.

A new sales office in Poughkeepsie, N.Y.—which will center greater attention on the expanding Hudson Valley area—has been opened by THE TRANE COMPANY, manufacturer of air conditioning, heating, ventilating and heat transfer equipment. The office will serve Ulster, Dutchess, Orange, Sullivan and Putnam counties. T. E. Kelly, manager of the company's Albany sales district under which the Poughkeepsie branch will function, also announced that Thomas E. Scott will move from Albany to be in charge of the new office. . . .

M. J. Hirshstein, president of JOSAM MANUFACTURING CO., has announced the acquisition of WADE MANUFACTURING COMPANY. Lewis H. Polster has been appointed president of the Josam Division of Josam Manufacturing Co., and Carl O. Tolf, Jr. has been appointed president of the Wade Division of Josam Manufacturing Co. Each division will operate autonomously. Charles W. Pfaff was appointed vice-president in charge of operations in Michigan City, and, in addition to his previous duties, will assume the responsibilities that were handled by A. L. Yeager. Mr. Yeager will remain associated with Josam in a consultative capacity. . . .

In conjunction with its continuing expansion program, JOHN J. NESBITT, INC., Philadelphia, Pa. manufacturer of heating and air conditioning equipment, will double its sales organization within the next six months. Expanding market areas and the recent termination of a long standing agreement with American Standard Industrial Division, who acted as sales agents for Nesbitt products to the school field, were the reasons given. . . .

PERSONNEL

John H. Eikenberg has been elected president of REVERE COPPER AND BRASS INCORPORATED and a member of its executive committee, effective July 1, 1961, to succeed Charles A. Macfie who has retired June 30th under the company's retirement plan, James M. Kennedy, chairman of the board, announced. Mr. Eikenberg, 51, who has been a vice president of Revere since 1945, joined the company as a clerk in the Baltimore Division in 1924. . . .

Frank E. Parsons, widely known thermal insulation engineer, has been appointed by ALLEN INDUSTRIES, INC. to direct national sales for their polyurethane foam products, now in production at their Rahway, N.J., Plant. Mr. Parsons brings to Allen Industries experience with all types of thermal insulations. He has pioneered and developed new products and new markets for existing products. An industry engineer for the National Mineral Wool Insulation Association, Mr. Parsons had been active in improving product and application standards. . . .

Newton W. Mac Nichol has joined BELL & GOSSETT CO., Morton Grove, Ill., as a special field representative for heating and cooling products in the company's Eastern Division. Mr. Mac Nichol, formerly general sales manager for Warren Webster & Co., will cover field calls in the territory assigned to the Eastern Division, with headquarters in New York City. . . .

* * *

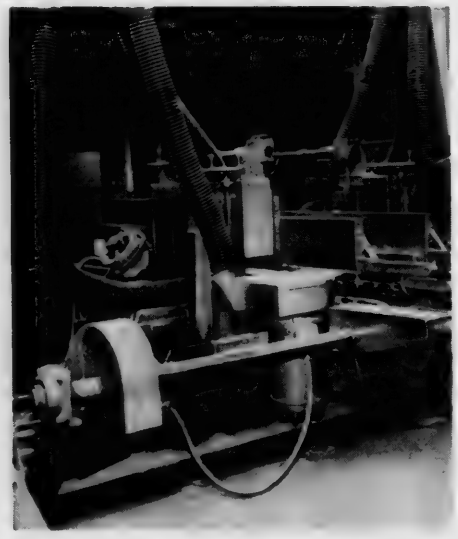
William E. Sloan, Founder and Chairman of the Board of SLOAN VALVE COMPANY, passed away June 25, 1961. Born in Liberty, Missouri, August 7, 1867, Mr. Sloan migrated to Chicago in his early years where he became a building tradesman as a gasfitter apprentice. Through intensive self-education, he developed a superior knowledge of electric circuitry and hydraulics which led to his 64 inventions. Among them was the Royal Flush Valve, the product with which he founded the Sloan Valve Company in October of 1906. He was a pioneer in the Plumbing Industry and through his inventive genius contributed much to the fundamental science of flush valve and vacuum breaker engineering.

(Continued on page 136)

FLEXAUST® HOSE

Dust Collection for Fume Control Materials Handling

MAKES GOOD INSTALLATIONS BETTER



Thousands of successful installations prove that use of Flexaust hose and Portovent retractable duct with metal duct systems lower installation costs — but there are other important advantages.

Exceptional abrasion resistance
Corrosion resistance
Noise absorption
Durability under heavy flexing
Provision for expansion and contraction
Easy relocation of hoods and machines

Made of high quality neoprene coated fabrics 1¼ to 36" i.d.

Write today for full details

Distributors in all principal cities

THE FLEXAUST CO.

DEPT. HV-8 100 PARK AVE. NEW YORK 17, N. Y.

the weil LOW RETURN CONDENSATE PUMP

with

- *LOW RETURN CONNECTION*
- *CAST IRON RECEIVER*
- *1750 RPM MOTORS*

UNIT NO.	SQ. FT. E.D.R.	CAP. G.P.M.	H. P.	PUMP DISCH.	HEIGHT OF RETURN	RETURN INLET
TVC 19	750	1.5	1/4	1"	6 7/8"	2"
TVC 23	1000	1.5	1/4	1"	6 7/8"	2"
TVC 29	2000	3.0	1/4	1"	6 7/8"	2"
TVC 35	4000	6.0	1/4	1"	6 7/8"	2"
TVC 41	6000	9.0	1/2	1"	6 7/8"	2"

Discharge pressure: 20 lbs. P.S.I.

Low speed (1750 RPM) assures long life and the float switch control built into this unit means trouble-free service. See Sweet's Catalog or send for Bulletin TVC-300 for full specifications and pumps with capacities to 15,000 sq. ft. EDR.

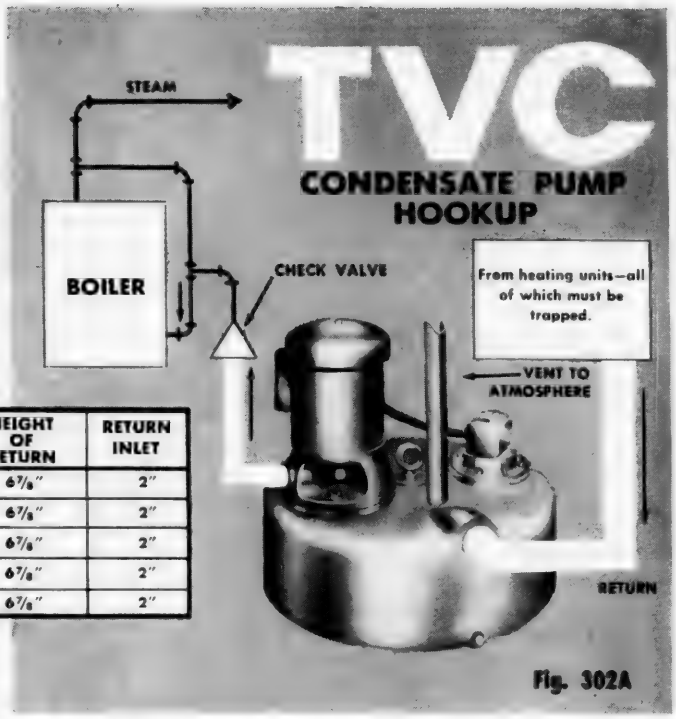


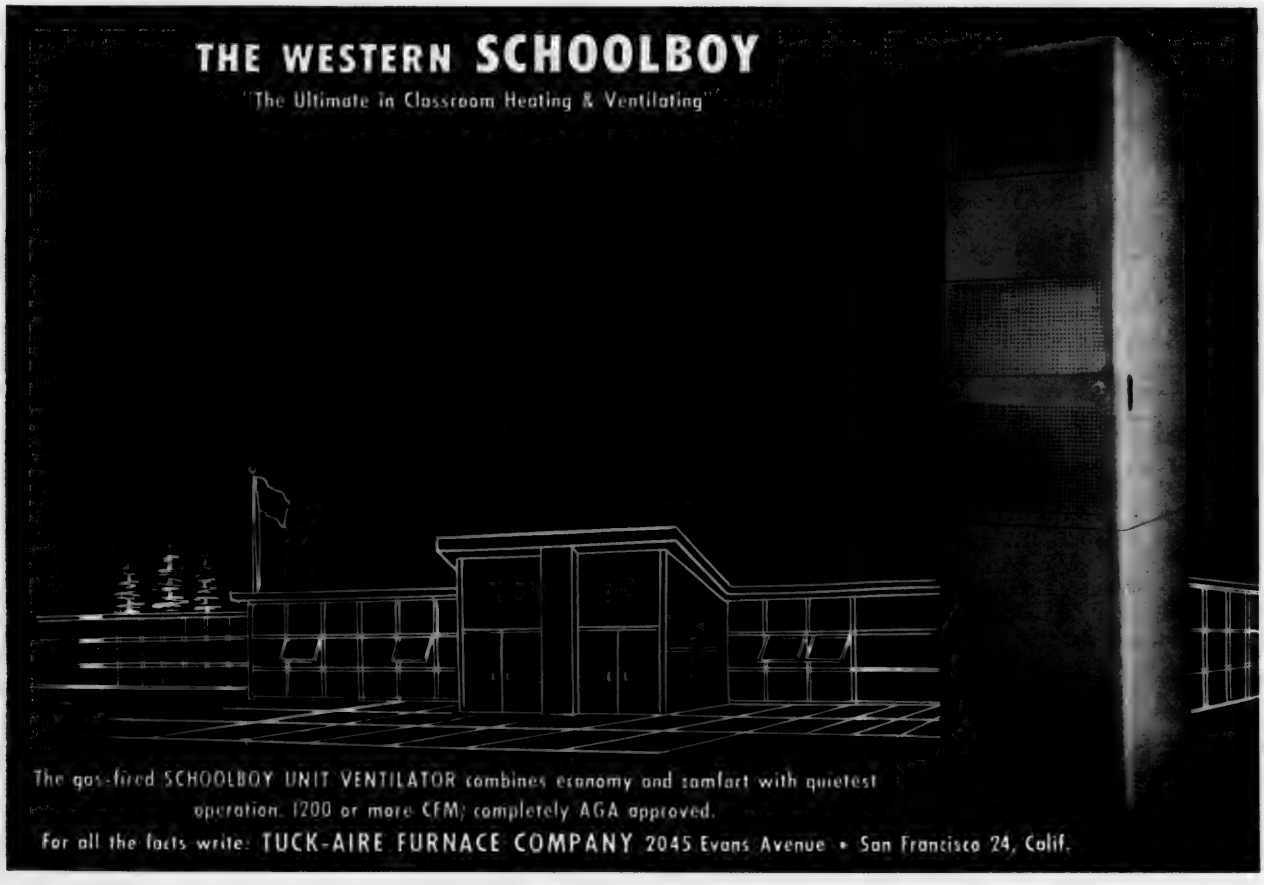
Fig. 302A

weil PUMP CO.

STOCKED BY THE BETTER JOBBERS

SEND FOR BULLETIN TVC-300.

1516 N. Fremont Street • Chicago 22, Illinois


THE WESTERN SCHOOLBOY
"The Ultimate in Classroom Heating & Ventilating"
The gas-fired SCHOOLBOY UNIT VENTILATOR combines economy and comfort with quietest operation. 1200 or more CFM; completely AGA approved.
For all the facts write: TUCK-AIRE FURNACE COMPANY 2045 Evans Avenue • San Francisco 24, Calif.

(Concluded from page 134)

ZURN INDUSTRIES, Erie, Pa., designer and manufacturer of building drainage controls, announced appointment of Elmer E. Spratford as sales engineer for its Hydromechanics Division in the New Jersey area and of John E. Glendon in the San Francisco area. Both will be calling on architects, engineers, contractors, and wholesalers in their respective territories. . .

Formation of a new wholesale firm, the Warren Distributing Company, to sell medium-size commercial and industrial air conditioning equipment in the Phoenix, Ariz. area, was announced by Fritz Fingado, manager of the Phoenix office of CARRIER AIR CONDITIONING COMPANY. J. S. "Cliffe" Warren, former vice-president and manager of Black & Ryan Air Conditioning Company of Phoenix, is president of the new firm which will be a distributor of Carrier equipment for custom engineered air conditioning systems. Black & Ryan will continue as wholesale distributor of packaged air conditioning units, with H. J. Marchant as sales manager. . .

Recent appointments of sales representatives for ILG ELECTRIC VENTILATING COMPANY were announced: Everett Chappell, manager of the Jackson, Miss., branch of R. K. Goode Co.; and for GENERAL BLOWER COMPANY, Folger H. Bigelow, Atlanta, Ga., Air Purification Co., Morton Grove, Ill., and Frank Stoffel Equipment Co., Columbus, Ohio.

Promotion of Ben Ragland to a position in charge of future planning, development and marketing of dust collection and air pollution control equipment has been announced by AMERICAN-STANDARD INDUSTRIAL DIVISION. Ragland will carry the title of product manager and will have his office at the Division's home office in Detroit. . .

Three product sales managers were appointed by Air Conditioning Division, WORTHINGTON CORP., East Orange, N. J. They are: George H. Diehl, Jr., for fans and fan coil units, Henry A. Caldwell, for induction and dual-duct units, and Paul G. Venable, for transportation equipment. . .

Charles R. Holsclaw, Charleston, W. Va., has been appointed eastern sales manager for MODINE MANUFACTURING CO., Racine, Wis. Mr. Holsclaw will establish headquarters in the general area of New York City. His territory will include the New England and Middle Atlantic states. . .

C. J. Wires, Sr. has been appointed chief production engineer for Heating & Air Conditioning Div., IRON FIREMAN MFG. CO., with headquarters in Cleveland. He has been associated with the division since 1948 as a draftsman, chief draftsman and project engineer.

NEW REPRESENTATIVES

J. F. David Co., Pittsburgh, Pa., and H. W. McKenzie Co., Portland, Ore., are named sales representatives for Air Conditioning Dept., Danville (Illinois) Div., BOHN ALUMINUM & BRASS CORPORATION. W. A. Edwards is appointed sales representative for the Division's OEM Coil and Commercial Refrigeration Departments. Mr. Edwards lives in N. Decatur, Ga., and will represent Bohn in Georgia and parts of Florida. . .

Forney Fuller & Associates, New Orleans, La., has been appointed sales representatives for WESTINGHOUSE ELECTRIC CORPORATION STURTEVANT DIVISION in the Louisiana, Mississippi, Texas, southern Arkansas, and western Tennessee areas, handling the complete line of heavy-duty and mechanical-draft fans in the southeastern area. Mr. Forney Fuller has been active in the power industry specializing in the sale, design, and maintenance of steam generators, fuel-burning equipment, and boiler auxiliaries.

AIR CONDITIONING THAT KEEPS ITS PROMISE OF PRECISION

NIAGARA Type "A" air conditioners assure that you actually realize all the benefits of precise atmospheric conditioning in your testing laboratory, your "clean room" or in your processing of hygroscopic materials.

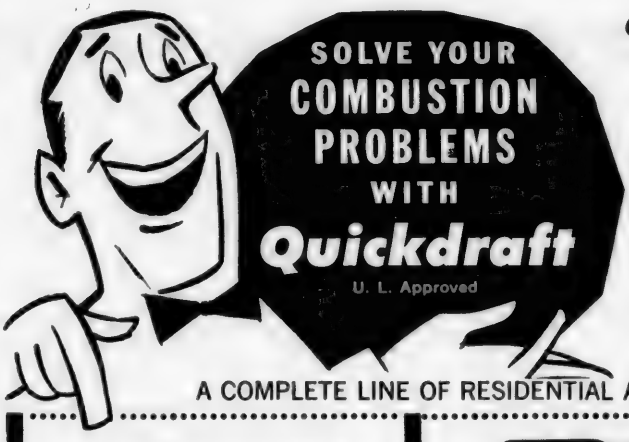
This assurance; temperatures controlled to a fraction of a degree, relative humidity held to within 1%, results because this unit, exclusively, can provide saturated air in such compact space. Its extra capacity absorbs sudden peak loads. You hold your standard conditions continuously, without interruption. With its simple, inexpensive control you can vary your standard at will and reach the new condition quickly. Its range, using the Niagara "No-Frost" liquid below the freezing point of water, is through 140° F. Its reliability is proven. Service records show many machines still precise in operation after 20 years' service.

Write for Bulletin 58 and 122

NIAGARA BLOWER COMPANY

Dept. HV-8 405 Lexington Ave., New York 17, N. Y.

District Engineers in Principal Cities



CHECK THESE FEATURES

- ✓ Stops pulsating and chattering
- ✓ Increases heating efficiency and ouptut
- ✓ One unit handles furnace or boiler, incinerator and hot water heater on single chimney
- ✓ Keeps furnaces, boilers and chimneys free of soot
- ✓ Stops blow-back of poisonous fumes
- ✓ Ideal for homes with outside chimneys
- ✓ Fireplace units with special fittings for direct installation into chimneys with single or two-speed motors available

Will operate with temperatures up to 1700 degrees

A COMPLETE LINE OF RESIDENTIAL AND LIGHT CONSTRUCTION MODELS

SIZES AVAILABLE
4 INCH
5 INCH
6 INCH
7 INCH

SIZES AVAILABLE
8 INCH
9 INCH
10 INCH

12 INCH

Patents
U. S. 2,722,372 and 2,855,874
British 802,920
Canadian 593,817
Other patents pending

10175-QD

WRITE FOR NEW LOW PRICES ON ALL THESE MODELS

HEAVY-DUTY INDUSTRIAL UNITS AVAILABLE
12" 14" 16" 18" 20" 22" 24" 30"
Larger sizes can be made to order

For corrosive service all Quickdraft units are available in standard acid-resisting vitreous enamel, 316 stainless steel, rigid plastics (P.V.C) and with plastic or Fiberglas coatings.

Quickdraft CORPORATION
P. O. Box 87-O
Canton 1, Ohio

U.S. PAT. PENDING

COMBINATION
MAGNETIC
HEX WRENCH AND PHILLIPS TYPE SCREWDRIVER SET

WATSCo

PART NO. P-13

Even the most inaccessible screw found in the hub of fans and blowers may be reached easily with these extra long (9") straight length hex wrenches; and each wrench is "magnetized' to enable the user to easily recover any fallen steel screw. A master handle with corresponding size openings, is included to facilitate the use of these wrenches. Also included are 3 standard size Phillips type screwdriver tips which snap onto either end of the ¼" wrench.

FEATURES:
- Handle slides to best working position on wrench
- Magnetic wrenches are made of fine tempered chrome vanadium steel
- Hardened steel screwdriver tips
- Packaged in hinged steel box.

FOR ADDITIONAL INFORMATION ASK YOUR WHOLESALER OR WRITE TO DEPT. V-8

WATSCo INC.
1020 E. 15th STREET—HIALEAH, FLORIDA

CALL US FOR AIR CLEANING HELP!

AFI MEMBER AIR FILTER INSTITUTE

Every building presents a special air cleaning problem. For the best solution — no matter what type of building you are working on — get expert help from members of the Air Filter Institute listed below. These companies are dedicated to giving you the assistance you need.

Box 85, Station E,
Louisville, Kentucky

Air Devices, Inc.
185 Madison Avenue
New York 16, New York

Air Filter Corporation
4554 W. Woolworth Avenue
Milwaukee 18, Wisconsin

Air-Maze Corporation
25000 Miles Road
Cleveland 28, Ohio

American Air Filter Co., Inc.
215 Central Avenue
Louisville 8, Kentucky

Continental Air Filters, Inc.
2520 Helm Street
Louisville 9, Kentucky

Dollinger Corporation
11 Centre Park
Rochester 3, New York

Drico Industrial Corporation
100 Eighth Street
Passaic, New Jersey

Fram Aire Company
Division of Fram Corporation
135 Zone Street
Henderson, N. C.

Minneapolis-Honeywell Regulator Co.
Minneapolis 8, Minnesota

Owens-Corning Fiberglas Corporation
1833 National Bank Building
Toledo 3, Ohio

Barnebey-Cheney Co.
Cassady at Eighth
Columbus 19, Ohio

Research Products Corporation
1015 E. Washington Avenue
Madison 10, Wisconsin

***Technical Filter Co.**
2719 South Poplar Avenue
Chicago 8, Illinois

Trion, Inc.
1000 Island Avenue
McKees Rocks, Pennsylvania

Union Carbide Development Co.
270 Park Ave.
New York 17, N. Y.

Vortex Company
121 S. Alexander Avenue
Claremont, California

Westinghouse Electric Corporation
Sturtevant Division
Hyde Park, Boston 36, Massachusetts

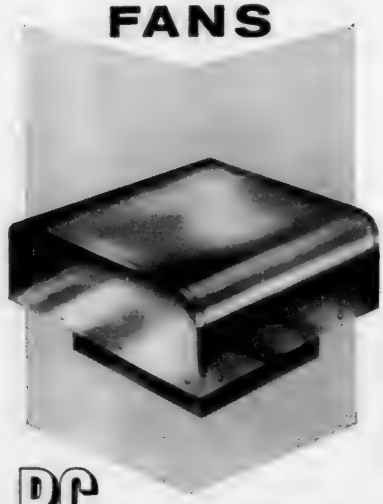
***Formerly Wilson & Co., Inc.**

LOW PROFILE

DAVIDSON

ROOF EXHAUST

FANS



PC *Pleasing Contour Model*

Designed to "hug the roof", the low-contour PC Model is as much as 40% lower than conventional units.

Capacities up to 50,000 CFM with low velocity.

- **Quiet, vibration-isolated operation**
- **Famous Davidson rugged construction**
- **NEMA Standard Motors**
- **Ratings conform to Standard Test Code**
- **Unconditional performance guarantee**

For complete facts about PC Fans and Hyduty SS Fans, write:

DAVIDSON FAN CO.

Dept. J, 213 California St.
Newton 58, Mass.

The original manufacturer of roof fans — Founded 1915

Member AMCA

UNITED STATES DEGREE

(A) Airport readings; (C) City office readings; (O) Readings at a point on outskirts of city

AIR CONDITIONING, HEATING AND VENTILATING'S 33rd Year of Publication of Monthly Degree-Day Data

City	June			Season to June 30 from Sept. 1		
	1961	1960	Normal	1961	1960	Normal
Abilene, Tex. (A)	3	0	0	2653	3048	2707
Albany, N. Y. (A)	47	32	50	7220	6634	6938
Albuquerque, N. M. (A)	0	0	0	4321	4286	4389
Alpena, Mich. (C)	216	177	135	8504	8498	7938
Anchorage, Alaska (A)	294	289	339	10261*	9960	10789*
Asheville, N. C. (C)	18	2	5	4316	4509	4072
Atlanta, Ga. (A)	5	0	0	2671	3226	2826
Atlantic City, N. J. (C)	21	12	24	5470	4743	4741
Augusta, Ga. (A)	1	0	0	2667	2830	2138
Baltimore, Md. (C)	5	0	0	4441	4263	4203
Billings, Mont. (A)	6	53	119	(a)	7068	7078
Binghamton, N. Y. (C)	(a)	43	48	(a)	6056	6520
Birmingham, Ala. (A)	4	0	0	2826	3093	2788
Bismarck, N. D. (A)	36	83	116	8068	8953	8967
Block Island, R. I. (A)	100	37	96	6044	5484	5816
Boise, Ida. (A)	13	23	92	5248	6402	5890
Boston, Mass. (A)	22	—	42	5955	—	5784
Buffalo, N. Y. (A)	90	48	72	7203	6598	6792
Burlington, Ia. (A)	11	14	34	6018	6607	6101
Burlington, Vt. (A)	91	81	72	8506	7576	7799
Cairo, Ill. (C)	3	0	0	4008	4344	3756
Charleston, S. C. (C)	2	0	0	2055	2203	1769
Charlotte, N. C. (A)	7	0	0	3491	3512	3205
Chattanooga, Tenn. (A)	2	0	0	3645	3864	3384
Cheyenne, Wyo. (A)	90	89	173	6973	7309	7490
Chicago, Ill. (A)	31	30	58	5995	6400	6310
Cincinnati, O. (C)	14	0	0	4595	4798	4532
Cleveland, O. (A)	95	58	46	6577	6166	5996
Columbia, Mo. (A)	15	1	14	4948	5629	5107
Columbia, S. C. (A)	3	0	0	2753	2936	2284
Columbus, O. (C)	25	2	22	5496	5497	5277
Concord, N. H. (A)	54	69	82	7635	6877	7544
Concordia, Kans. (C)	2	[illegible]	20	5149	6107	5323
Dallas, Tex. (A)	4	0	0	2331	2793	2272
Denver, Colo. (A)	65	38	65	5514	6254	6116
Des Moines, Ia. (A)	12	13	45	6312	7186	6429
Detroit, Mich. (A)	47	43	60	6301	6373	6396
Devils Lake, N. D. (C)	49	118	137	9267	10312	9832
Dodge City, Kans. (A)	9	13	15	4837	5652	5058
Dubuque, Ia. (A)	40	57	76	7153	7774	7235
Duluth, Minn. (A)	160	204	200	9171	9843	9417
El Paso, Tex. (A)	0	0	0	2820	2514	2641
Ely, Nev. (A)	128	86	200	7109	7628	7377
Escanaba, Mich. (C)	169	156	166	7205	8394	8500
Evansville, Ind. (A)	11	5	6	4696	5100	4360
Fairbanks, Alaska (A)	180	261	193	14009*	13567	13713
Fargo, N. D. (A)	41	87	101	8766	9413	9208
Fort Smith, Ark. (A)	0	0	0	3373	3815	3188
Fort Wayne, Ind. (A)	40	35	53	6320	6493	6270
Fort Worth, Tex. (A)	2	0	0	2457	2855	2361
Fresno, California (A)	1	0	0	2757	2392	2532
Galveston, Tex. (C)	0	0	0	1288	1573	1211
Grand Junction, Colo. (A)	2	0	0	5259	5753	5796
Grand Rapids, Mich. (A)	71	65	79	6746	6932	7027
Green Bay, Wisc. (A)	85	124	107	7760	8286	8169
Greensboro, N. C. (A)	10	0	0	4123	4247	3810
Greenville, S. C. (A)	6	0	0	3181	3542	3060
Harrisburg, Pa. (A)	22	3	14	5697	5246	5258
Hartford, Conn. (A)	27	28	31	6549	5943	6125
Havre, Mont. (A)	9	98	125	7122	8172	8155
Helena, Mont. (A)	21	134	197	6925	8306	8202
Houston, Tex. (C)	0	0	0	1344	1655	1276
Huron, S. D. (A)	54	53	80	8256	8763	7876
Indianapolis, Ind. (A)	35	24	30	5939	6051	5611
Jackson, Miss. (A)	2	0	0	2437	2861	2202
Juneau, Alaska (A)	371	409	342	8260*	7670	8888*
Kansas City, Mo. (A)	5	2	[illegible]	4809	5363	4888
Knoxville, Tenn. (A)	6	0	0	3895	4027	3590
La Crosse, Wisc. (A)	28	57	74	7209	7614	7619
Lander, Wyo. (A)	61	67	163	7430	—	8273
Lewiston, Me. (O)	60	70	45	7548	6903	7707
Lincoln, Nebr. (C)	7	11	32	5692	6695	5858
Little Rock, Ark. (A)	0	0	0	3288	3541	2982
Los Angeles, Calif. (C)	11	0	0	870	913	1451
Louisville, Ky. (A)	23	6	5	4989	4748	4439
Lynchburg, Va. (A)	17	1	5	4487	4518	4153

DAYS FOR JUNE, 1961

City	June			Season to June 30 from Sept. 1		
	1961	1960	Normal	1961	1960	Normal
Macon, Ga. (A)	3	0	0	2188	2583	2049
Madison, Wisc. (A)	62	77	79	7396	7864	7260
Marquette, Mich. (C)	191	199	189	8189	8535	8373
Memphis, Tenn. (A)	2	0	0	3332	3589	3137
Meridian, Miss. (A)	0	0	0	2542	2890	2333
Milwaukee, Wisc. (A)	86	132	109	7243	7554	7153
Minneapolis, Minn. (A)	43	82	80	7432	8169	7828
Moline, Ill. (A)	12	13	45	6349	6920	6356
Montgomery, Ala. (A)	1	0	0	2464	2514	2137
Nashville, Tenn. (A)	4	0	0	3897	4223	3513
New Haven, Conn. (A)	31	18	52	6145	5588	6008
New Orleans, La. (C)	0	0	0	1187	1558	1175
New York (Central Park)	6	(a)	7	5047*	4805*	4965*
New York (International A)	10	(a)	(a)	5219*	(a)	(a)
New York (La Guardia A)	3	(a)	10	5040*	(a)	4989*
Newark, N. J. (A)	3	0	11	5212	4844	5252
Norfolk, Va. (A)	16	1	0	3729	3566	3454
North Platte, Nebr. (A)	37	48	59	6459	7426	6529
Oak Ridge, Tenn. (C)	5	0	0	3976	4210	3880
Oakland, Calif. (A)	74	56	119	2856	2429	3002
Oklahoma City, Okla. (A)	0	0	0	3551	4255	3519
Omaha, Nebr. (A)	18	12	32	5864	6908	6155
Parkersburg, W. Va. (C)	21	3	13	4991	5097	4750
Peoria, Ill. (A)	29	18	41	6338	6658	6076
Philadelphia, Pa. (C)	5	2	0	4677	4436	4523
Phoenix, Ariz. (A)	0	0	0	1370	1451	1492
Pittsburgh, Pa. (C)	23	6	13	5391	5185	5048
Pittsfield, Mass. (A)	101	101	105	7718	7226	7606
Portland, Me. (A)	95	89	117	7783	7135	7610
Portland, Ore. (C)	47	69	70	3555	4294	4116
Providence, R. I. (A)	26	30	58	6233	5748	6099
Pueblo, Colo. (A)	29	7	27	5381	6092	5709
Raleigh, N. C. (A)	8	2	0	3763	3870	3075
Rapid City, S. D. (A)	25	58	148	6490	7817	7479
Reading, Pa. (C)	7	1	11	5389	4971	5055
Red Bluff, Calif. (A)	0	0	0	2650	2476	2546
Reno, Nev. (A)	55	42	165	5685	6051	5948
Richmond, Va. (A)	7	2	0	4223	4213	3955
Rochester, N. Y. (A)	64	56	54	6984	6829	6820
Roswel, N. M. (A)	1	0	0	4081	3628	3424
Sacramento, Calif. (C)	3	0	5	2593	2335	2600
St. Joseph, Mo. (C)	5	4	11	5364	6123	4703
St. Louis, Mo. (C)	25	1	7	4458	5053	4469
Salt Lake City, Ut. (A)	14	14	81	5426	6156	5866
San Antonio, Tex. (A)	0	0	0	1552	1947	1579
San Diego, Calif. (A)	43	4	43	1139	1010	1556
Sandusky, O. (C)	48	17	41	6009	6045	5859
San Francisco, Calif. (C)	167	176	180	2761	2299	2703
Sault Ste. Marie, Mich. (A)	262	227	224	8980	9030	9240
Savannah, Ga. (A)	4	0	0	1995	2276	1710
Scranton, Pa. (A)	44	29	35	6939	6289	6029
Seattle, Wash. (C)	63	109	107	4011	4323	4344
Sheridan, Wyo. (A)	24	73	161	6799	7785	7835
Shreveport, La. (A)	5	0	0	2256	2742	2117
Sioux City, Ia. (A)	11	15	54	6616	7727	6987
Spokane, Wash. (A)	70	118	146	6370	7294	6807
Springfield, Ill. (A)	22	14	14	5669	6079	5225
Springfield, Mo. (A)	(a)	0	16	(a)	5167	4685
Syracuse, N. Y. (A)	42	47	37	6956	6561	6491
Toledo, O. (A)	92	62	60	5711	6609	6382
Topeka, Kansas (A)	3	3	15	5156	5906	4919
Trenton, N. J. (C)	11	3	11	5350	4883	5068
Tulsa, Okla. (A)	0	0	0	3612	4195	3584
Utica, N. Y. (O)	11	28	0	5967	6170	6796
Valentine, Nebr. (A)	52	47	83	6959	7959	7054
Walla Walla, Wash. (C)	14	34	38	4394	5231	4848
Washington, D. C. (A)	6	0	0	4641	4270	4258
Wichita, Kans. (A)	0	1	7	4592	5198	4571
Williston, N. D. (C)	22	117	138	7923	9126	8997
Winnemucca, Nev. (A)	44	22	111	5053	6704	6352
Yakima, Wash. (A)	55	70	53	5671	6335	5838

a) Data not available.

* Includes July and August.

Normal figures in this table are based on 30-year period covering 1921 to 1950, inclusive, as compiled and published by the U. S. Weather Bureau.

Figures in this table, with two exceptions, based on local weather bureau reports. Exceptions are Utica and Lewiston, figures for which are furnishd through the courtesy of Coke Sales Department, Central New York Power Co., Utica, N. Y., and Norman E. Ross, Bursar, Bates College, Lewiston, Me., respectively.

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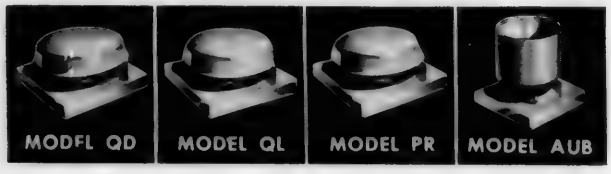

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BOOK REVIEWS

Publications abstracted in this department should be ordered direct from publisher.

INSULATION MANUAL—A new, expanded edition of the Manual on Economic Thickness of Insulation, originally prepared by Union Carbide Chemicals Company and West Virginia University, has been published by National Insulation Manufacturers Association. Parts of the manual, which is applicable to practically all heat-using facilities, have been published in *Air Conditioning, Heating and Ventilating.*

The original Manual was the first practical reduction to charts and tables of the numerous unwieldy variables that prevented the simple calculation of exact thickness of thermal insulation to give the optimum return on investment over the years. Despite the availability of exact heat transfer and steam cost formulas published by L. B. McMillan in 1926, the mathematical processes required to specify insulation for each run of pipe or piece of equipment were so complex that most specifications were by rule of thumb or according to the surface temperature of the insulation. Too much or too little insulation was the result. An actual installation reported in the book shows that a certain plant, insulated with 1½ inches of insulation before the study was undertaken, was costing the user $0.18 per foot of pipe per year more than it would have cost with a properly calculated thickness of 2½ inches.

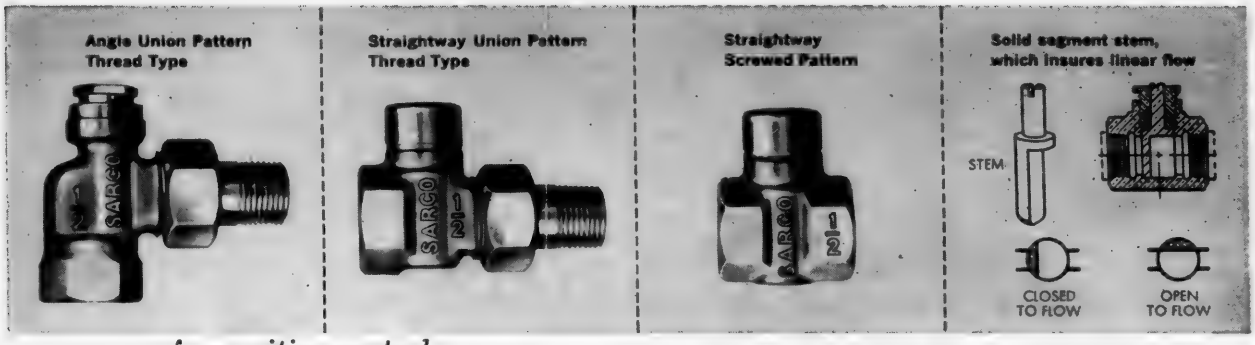
Although the original manual was planned only to effect economies in Union Carbide plants, it was quickly seen to apply to almost all heat-using plants in any industry, all over the world. The National Insulation Manufacturers Association was granted permission by the Union Carbide Corporation to make the system available to the public.

The new re-written edition extends the capital investment charts to cover steam costs from $2 per pound of steam per hour to $24, and to include an alternate method of using the charts, based on plant depreciation periods. It is possible for each plant to select from the 17 graphs and 126 pages of economic thickness tables just the data that apply to a specific condition, once the local cost factors are known.

The new 180 page Manual, entitled "How to Determine Economic Thickness of Insulation" is available from the National Insulation Manufacturers Association, 441 Lexington Ave., New York 17, N. Y., at eight dollars per copy.

FIELD COST ACCOUNTING—A *Suggested Guide for Field Cost Accounting* is published by The Associated General Contractors of America, Inc., 1957 E Street, N.W., Washington 6, D. C. While the Guide is intended to be adapted for use to fit circumstances, it is intended to promote the use by general contractors of well-defined procedures. Concerned about

(Continued on page 142)



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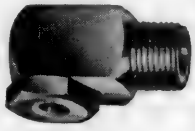

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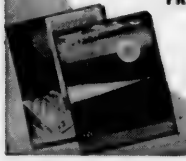

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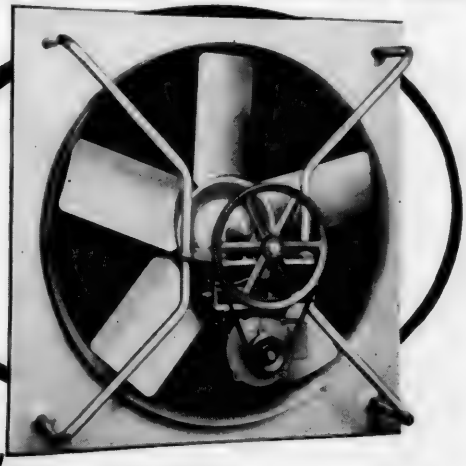

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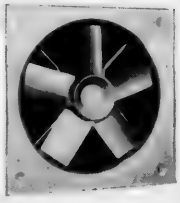

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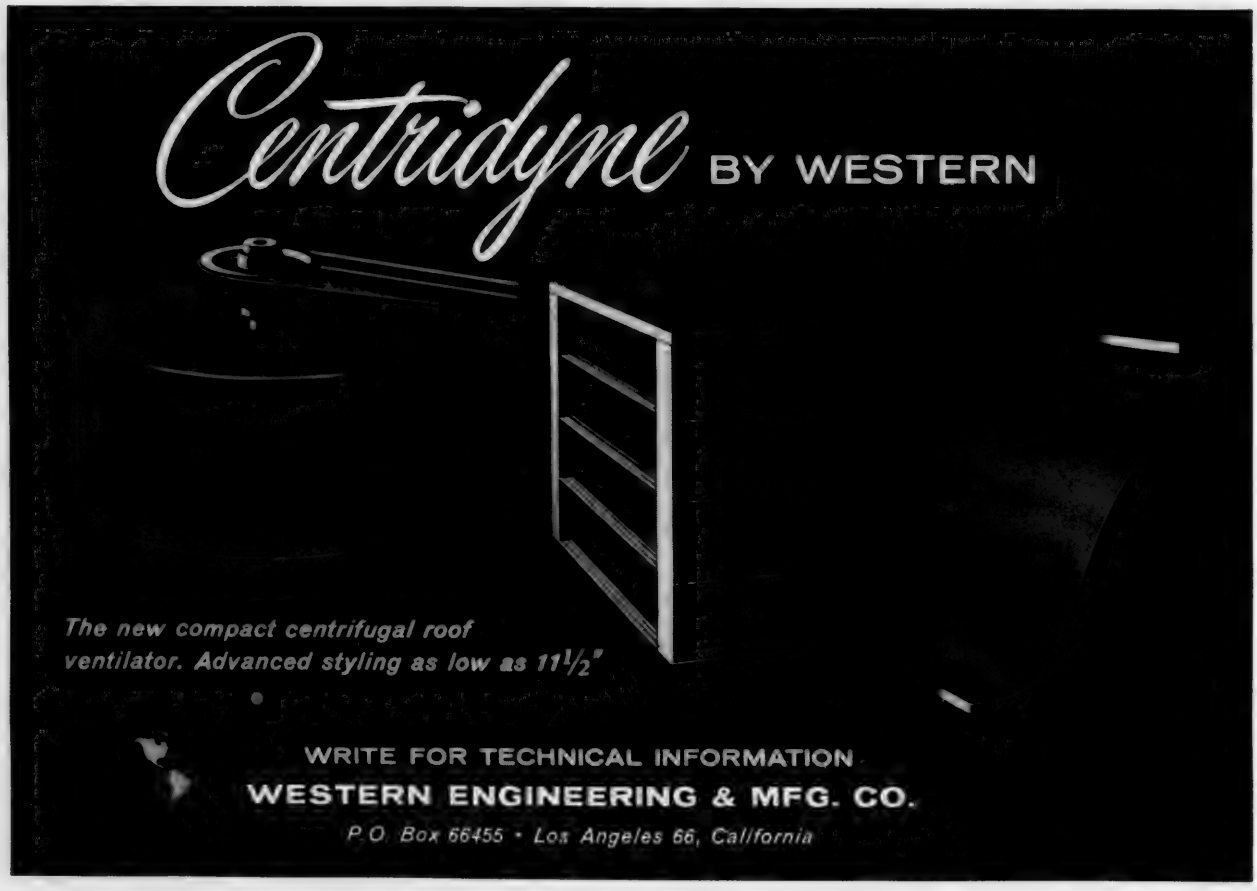
(Continued from page 140)

the high rate of business failures in the construction industry, AGC consulted with many leading AGC member executives, to learn what forms they use. The booklet is a composite of the best. It is presented in three parts: (1) preparation of project estimate using a standard system; (2) job labor and material cost distribution, covering recording and distribution of field labor and material according to a standard cost accounting system; and (3) preparation of cost reports in a manner that will give the company a complete and realistic forecast of the job outcome, give management a clear idea of the field costs vs. material and subcontract estimates, and, equally important, up-to-date and accurate figures for the bank and bonding company. Price is $2.50 per copy for non-members, $1.25 for AGC members.

PIPE FRICTION MANUAL—A third edition of its very valuable *Pipe Friction Manual* is available from The Hydraulic Institute, 122 East 42nd Street, New York 17, N. Y. It is an extension and rearrangement of the pipe friction data contained in the previous edition and in an earlier publication entitled "Tentative Standards of the Hydraulic Institute—Pipe Friction". Data are based on the latest information available. Included are complete tables of friction loss for water for wrought iron, steel and cast iron pipe sizes from ⅛ to 84 inches; tables of resistance coefficients for valves and fittings, 90-degree bends, diffusers, and others; full-page charts showing friction loss for viscous fluids (re-drawn for greater clarity); three fold-in charts for calculating friction loss for any liquid or gas in any shape or size conduit; and numerous examples showing solutions to typical problems. Price is $2.

WELDED STEEL TUBING—A comprehensive new manual on welded steel tubing, including the latest engineering and design data in the manufacture and fabrication of electric resistance welded carbon and stainless steel tubing, has been published by the Welded Steel Tube Institute, 1604 Hanna Bldg., Cleveland, Ohio. Entitled *Handbook of Welded Steel Tubing*, it details the newest technological advances made in production and fabrication of welded steel tubing. The Handbook compiles engineering data as an aid in simplifying the work of architects, designers, engineers and fabricators of all types of tubular products. Included for the first time in the fabrication section of the Handbook is a completely illustrated chapter on joining methods as applied to welded steel tubing. This includes both welded and mechanical methods. Also featured are complete requirements for successful bending, swaging, expanding, flanging and beading, and upsetting. Price is $10.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COMING EVENTS

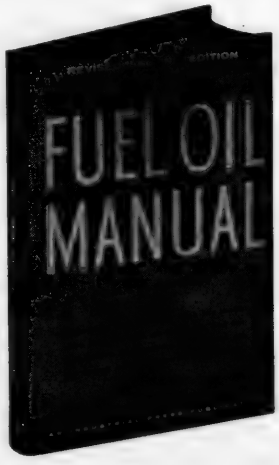
Where listed, names or titles of individuals are those from whom further information is available.

NACE ANNUAL CONFERENCE—18th Annual Conference and 1962 Corrosion Show of the National Assoc. of Corrosion Engineers, 1061 M & M Building, Houston 2, Texas, to be held in Kansas City Auditorium with the Muehlebach Hotel as headquarters. T. J. Hull, Executive Secretary. Overall charge of both the conference and corrosion show L. W. Gleekman, Wyandotte Chemical Corp., Wyandotte, Michigan. .....**MARCH 19-23, 1962.**

AMERICAN INDUSTRIAL HYGIENE CONFERENCE—Exhibits and Conference under the joint sponsorship of the American Industrial Association and the American Conference of Governmental Industrial Hygienists, will be held at the Sheraton Park Hotel, Washington, D. C. William S. Johnson, Medical Div. Bethlehem Steel Co., Bethlehem, Pa. .....**MAY 13-17, 1962.**

ASTM ANNUAL MEETING—Annual Meeting of the American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa., at Statler Hotel, New York City, in conjunction with apparatus exhibit. .....**JUNE 24-29, 1962.**

(Continued on page 144)



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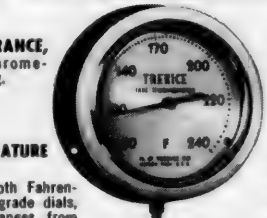

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(Continued from page 143)

INTERNATIONAL CONFERENCE—The International Heat Transfer Conference will be held at the University of Colorado, Boulder, Colorado. Nonmembers are welcome. For information write: The American Society of Mechanical Engineers, 29 West 39th St., New York 18, N. Y. .....**AUGUST 28-SEPTEMBER 1, 1961.**

SOUTHEASTERN SHOW AND SEMINAR—The meeting of the third Southeastern Show will be held at the War Memorial Coliseum, and the third Southeastern Seminar at the adjoining Town Hall, Greensboro, N. C. Robert E. Zimmerman, show manager, Box 3173, Greensboro, N. C. J. R. Ogburn, Seminar chairman, Box 907, Raleigh, N. C. .....**SEPTEMBER 12-14, 1961.**

INDUSTRIAL BUILDING EXPOSITION—Nineteen conference sessions, covering problems of large and small companies will feature the second Industial Building and Congress, to be held at the New York Coliseum. For details write to Clapp & Poliak Inc., 341 Madison Ave., New York 17, N. Y. ....**SEPTEMBER 25-28, 1961.**

WELDING FALL MEETING—The American Society fall meeting will be held in the Adolphus Hotel, Dallas, Texas. For further details write to the Information Center, American Welding Society, 33 West 39th St., New York 18, N. Y. ..**SEPTEMBER 25-28, 1961.**

INDUSTRIAL HYGIENE FOUNDATION—The 26th annual meeting of the Industrial Hygiene Foundation of America Inc. will be held at the Mellon Institute, 4400 Fifth Avenue, Pittsburgh 13, Pa. Dr. H. H. Schrenk, Managing Director, 4400 Fifth Avenue, Pittsburgh 13, Pa. .....**OCTOBER 25-26, 1961.**

CONSULTING ENGINEERS COUNCIL—Semi-annual meeting of CEC Board of Directors, Miami Beach, Fla. Larry N. Spiller, executive secretary, 322 Reisch Bldg., Springfield, Ill. ....**NOVEMBER 2-4, 1961.**

R.S.E.S. INTERNATIONAL CONVENTION—The 24th annual Refrigeration Service Engineers Society International Convention will be held at the Royal York Hotel, Toronto, Ontario, Canada. Information: Convention Committee Secretary, M. F. Peddie, 51 Haven St., Toronto 19, Canada. .....**NOVEMBER 2-5, 1961.**

NATIONAL WARM AIR—The 48th Annual Convention will be held at the La Salle Hotel, Managing Director, James M. Martin. National Warm Air Heating and Air Conditioning Association, 640 Engineers Building, Cleveland 14, Ohio. ....**NOVEMBER 6, 1961.**

BRI FALL CONFERENCES—Building Research Institute Spring Conference, Shoreham Hotel, Washington, D. C. BRI, 2101 Constitution Ave., Washington 25, D. C. ....**NOVEMBER 14-16, 1961.**

BHC COUNCIL MEETING—The sixth annual meeting of the national Better Heating-Cooling Council will be held at the Hotel Delmonico, New York City, N. Y. For information write Ray Schumack, 250 Park Ave., New York 17, N. Y. ....**DECEMBER 18-19, 1961.**

ARI EXPOSITION—Air Conditioning and Refrigeration Institute, 12th Exposition, Pan-Pacific Auditorium, Los Angeles. Information: George E. Mills, ARI Show Director, 1346 Connecticut Ave. N.W. Washington 6, D. C. .....**FEBRUARY 12-15, 1962.**

ELECTRIC HEATING SHOW—The Second National Electric House Heating Symposium and Exposition, sponsored by Electric House Heating Section, National Electrical Manufacturers Association, 155 East 44th Street, New York 17, N. Y., to be held at the Sherman Hotel, Chicago, Ill. Write Russell Gingles, NEMA director of public relations. .....**MARCH 19-21, 1962.**

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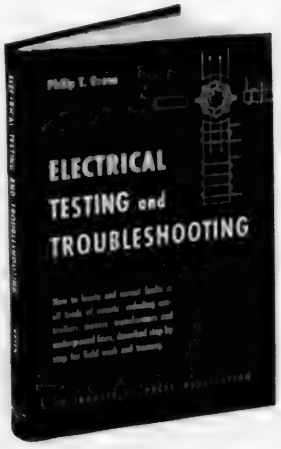

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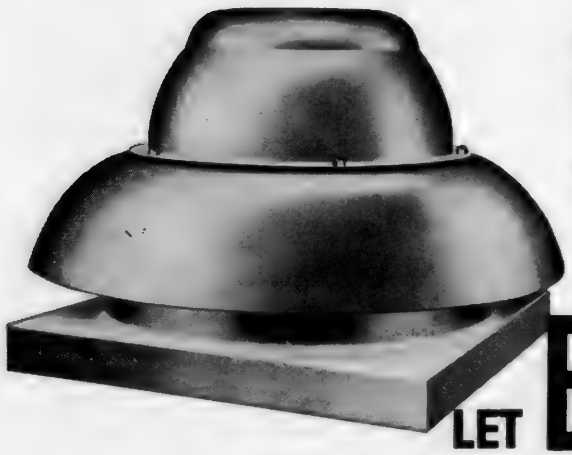

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REVOLVING	Gravity	123 to 10,931	17	17	Sideward
STANDARD GRAVITY	Gravity	35 to 24,890	19	19	Upward
THERMAVENT	Gravity	MADE TO ORDER		2	Upward
CENTRIFLOW	Power	65 to 36,430	56	184	Downward
FREE EXHAUST FAN	Power	5,000 to 75,550	7	17	Upward
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EXPANDABLE BOILERS by H. B. Smith provide for future requirements without expensive boiler room enlargement. Merely add more sections.
Page Inside Front Cover Item 200

O. F. & T. STEAM TRAPS by Armstrong are designed especially for heating systems. Bulletin No. 775 and Unit Heater Bulletin No. 801 offered.
Page 1 Item 201

POWER ROOF EXHAUSTER by Penn Ventilator is designed for all types of buildings where ovens, hearths and ranges are used. Throws fuse and odors high into the air. Bulletin RGX-60.
Page 2 Item 202

GAS HEATING UNITS in a complete line are offered by Nesbitt. Includes sealed-flame, propeller fan, blower fan unit heaters, and duct furnaces. Literature available.
Page 5 Item 203

PNEUMATIC CONTROLS are discussed in latest Powers catalog on efficient, economical controls for schools and other structures.
Pages 6-7 Item 204

CENTRIFUGAL CONDENSATE PUMPS by Hoffman are your most economical pump buy. Require minimum service. Information available.
Page 9 Item 205

SMOOTH-FIN COILS for heating and cooling by Aerofin provide big capacities in small spaces. Bulletin S-55.
Page 11 Item 206

SEASONMAKERS by McQuay provide dependable, individual room air conditioning with either cabinet or built-in units. Information is available.
Page 13 Item 207

MAKE-UP AIR BOOKLET offered by Westinghouse Electric Corp., Sturtevant Div., advises on installation of separate fans to supply make-up air.
Page 15 Item 208

HEATING SPECIALTIES by Marsh are detailed in up-to-date catalog 76-H covering valves, traps, vents, F & T traps.
Page 16 Item 209

BIG CONDENSING UNITS with Fandaire design from Yuba available from 3-90 hp with air cooled condenser and single or multiple compressor. Details available.
Page 17 Item 210

NEW CLOSET CARRIER SYSTEM, the Zurn "Monolithic", is the only behind-the-wall system for long-run batteries of off-the-floor siphon-jet wc's without expensive modifications or weakening structural slabs. Engineering data manual offered.
Pages 18-19 Item 211

POLYPHASE MOTORS made by Wagner in ratings through 10 hp are resilient mounted—quiet. All the help you need in selecting the right motor is available.
Page 20 Item 212

GAS-FIRED duct heater assemblies and fresh air supply heaters available from L. J. Wing. Feature high efficiency, fuel economy, and long life. Bulletins GA-61, GFAS-60.
Page 21 Item 213

FLUSH VALVES by Sloan are likely to be the smallest item in the building maintenance budget—as little as 1½ cents per valve per year according to records of Stevens Hotel in Chicago.
Page 22 Item 214

PROPELLER FAN BULLETIN 613 offered by The New York Blower Co. has full information on units for both supply and exhaust.
Page 23 Item 215

ALCO SOLENOID VALVES are specified for troublefree performance for every refrigerant control application: Liquid, suction, hot gas, brine, water, steam, and air. Bulletin 173-55.
Page 25 Item 216

GILSULATE underground hot pipe insulation has been installed in 12 AEC plants in the United States and three plants in foreign countries. Technical information available.
Page 26 Item 217

REFRIGERANT DISTRIBUTORS by Sporlan have versatile interchangeable nozzles for peak coil performance. All the facts in bulletin 20-10.
Page 27 Item 218

TYPE J GAS BOILER by Weil-McLain needs no high chimney nor draft fan. Conforms to AGA venting requirements. Bulletin C-297.
Page 28 Item 219

FLOW SWITCHES by McDonnell & Miller are compact, well built, making or breaking a circuit as required when liquid flows or stops flowing. Bulletin FS 1 explains.
Page 29 Item 220

JENKINS VALVES are the choice of engineers who design the best bank buildings in the country. Their clients want a sound investment.
Page 30 Item 221

SHOCK ABSORBERS by Josam are installed in water supply lines which then stay quiet. Manual SA provides complete information.
Page 31 Item 222

ABSORPTION REFRIGERATION is highly efficient with low operating cost when a Carrier gas-operated unit is specified, American Gas Association states. Carrier has complete information.
Page 32 Item 223

PETRO PACKAGE GENERATOR wrings more heat from the fuel dollar in less space in small-to-big commercial and industrial buildings—heating and process. Specification sheets, price data available.
Pages 33-36 Item 224

GENETRON is now being produced in a third, brand new plant in Elizabeth, N.J., by Allied Chemical's General Chemical Div., assuring you of dependable supplies of this high quality refrigerant.
Page 37 Item 225

IRONFIREPAK is the name of a completely new family of generators designed around a service-proved firing system with exceptional performance. Wide range fits all heating and power applications. Information available from Iron Fireman.
Pages 38-39 Item 226

UNIT HEATERS are made by Ilg for gas, steam, electric. Models install on ceilings or walls. Both propeller type and centrifugal type available. Choose between cabinet, other models. Catalogs available.
Pages 40-41 Item 227

MULTI-VELOCITY industrial air filter for heating or air conditioning made by Research Products Corp. gives you more, costs you less. Information available.
Page 42 Item 228

CONDENSATE RETURN UNITS by Aurora feature smooth, quiet operation, high efficiency, less initial cost, lower operating expense and compactness. Information available.
Page 43 Item 229

ELECTRIC-ELECTRONIC CONTROL by Barber-Colman is the logical, modern way to handle temperature communications systems in any size or type of building. Literature available.
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THE WIDEST RANGE of air and liquid handling equipment in the industry is available from Air Handling Div., Buffalo Forge Co. Sound engineering recommendations are at your disposal.
Page 47 Item 231

ELECTRIC BLAST COIL HEATERS for unusual and standard heating problems; for duct installation or package air conditioners; are discussed in new catalogs available from Industrial Engineering & Equipment Co.
Page 51 Item 232

EASY HANDLING GAS BOILER by Bryant is recommended for new construction or replacement. Installs in sections. Information on the Series D630 available.
Page 113 Item 233

CENTRAL SYSTEM CONDITIONERS by Halstead & Mitchell available in choice of 6, 7, 8 or 10 fins per inch for easy matching of central fan-coil to a particular job. Bulletin AHU-100.
Page 115 Item 234

MOTOR OPERATED VALVES for fan-coil units are now available in reliable, quiet models from Erie Mfg. Co. Easily installed, works in any position, has 100% shut-off. Bulletin 210 explains.
Page 117 Item 235

NEW AIR-COOLED CONDENSERS available from Carrier feature capacities from 3 tons, low silhouettes, higher efficiencies, and lower maintenance. Install wherever outside air is available. Details offered.
Page 119 Item 236

EVERLASTING VALVES are specified for fast, easy opening and closing. Leak-proof seal and straight-through flow assure minimum pressure drop. Bulletin available.
Page 121 Item 237

THE HONEYWELL THERMOSTAT has new internal mechanism, with fewer working parts, a low-mass sensing element. New exterior available in nine new finishes.
Pages 122-123 Item 238

STRIPLINE DIFFUSERS made by Air Devices, Inc. are now available in extruded aluminum. Technical catalog ES-105.
Page 124 Item 239

ALNOR PYROCON is the fast, accurate and easy instrument for getting surface temperature readings. Information available.
Page 125 Item 240

ROOF-MOUNT CONDITIONERS by Ventil-Aire saved 12% on installation and 7% in construction costs. In 5- to 15-ton sizes. Literature available.
Page 126 Item 241

COPPER TUBE BULLETIN, Publication B-1, by Anaconda American Brass Co. provides complete information about copper tube and fittings for general plumbing, heating, air conditioning.
Page 127 Item 242

AMCA WHO'S WHO is available to users and specifiers of air moving equipment by Air Moving and Conditioning Association. The 54-page directory of manufacturers and products licensed to use certified ratings seal is Bulletin 261A.
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"SU" HEAT EXCHANGER made by Bell & Gossett for economically heating water with steam is covered completely in Catalogs SC-159 and SI-159.
Page 129 Item 244

LAYKOLD INSULATION ADHESIVE is a "natural" for builders when applying the tilt-up technique to refrigerated warehouse construction. Data available.
Page 130 Item 245

HARTZELL ROOF VENTILATORS are prescribed for efficient, economical exhaust of heat, smoke, fumes. Reversible unit available. Details available.
Page 131 Item 246

INDUSTRIAL EXHAUST is best handled by Lehigh I. E. industrial fans because of tough wheel which handles dust laden air and gases, paper shavings without clogging. Bulletin L-5.
Page 132 Item 247

CHEMICAL MAINTENANCE PRODUCTS available from Metropolitan Refining Co. cover the complete field of heating and air conditioning. Data available.
Page 133 Item 248

FLEXAUST HOSE for dust collection, fume control, and materials handling makes any installation a better one. Neoprene coated fabrics to 36-inch dia. Full details available.
Page 134 Item 249

CONDENSATE PUMPS by Weil feature low return connections, cast iron receivers, and 1750-rpm motors. Bulletin TVC-300 has full specifications.
Page 135 Item 250

WESTERN SCHOOLBOY is called "the ultimate in classroom heating and ventilating" by unit ventilator manufacturer Tuck-Aire Furnace Co. Models AGA approved.
Page 135 Item 251

PRECISE AIR CONDITIONING is provided by Niagara Type A air conditioners for the exact conditions you prescribe for lab, clean room, or process. Bulletins 58 and 122.
Page 136 Item 252

QUICKDRAFT units solve your combustion problems. A complete line of residential and light construction models. No motors, blowers, in exhaust line.
Page 137 Item 253

COMBINATION SET by Watsco includes magnetic hex wrench and Philips type screw driver set. Packaged in hinged steel box. Information available.
Page 137 Item 254

LOW PROFILE EXHAUST FAN by Davidson is as much at 40% lower than conventional unit. Capacities to 50,000 cfm with low velocity. Complete facts offered.
Page 138 Item 255

CORDLEY WATER COOLERS carry a full five-year guarantee, the strongest in the industry. There are 28 job-rated models from which to choose. Catalog 61.
Page 139 Item 256

ALL-ALUMINUM VENTILATORS by Cook are your solution to ventilation problems. Carries 5-year warranty. Copy of 1961 Controlled Ventilation Catalog offered.
Page 140 Item 257

SPRAY NOZZLES by Spraying Systems Co. Permit exact control of spray characteristics in a complete range of sizes. Bulletins 81 and 82.
Page 141 Item 258

SIDEWALL AXIAL BELTED FAN by Greenheck is brand new. Can be used as supply or exhaust by reversing blade. Latest catalog contains complete details and specifications.
Page 141 Item 259

CENTRIDYNE by Western is a new compact centrifugal roof ventilator with advanced styling as low as 11½ inches. Technical information offered.
Page 142 Item 260

HARRIS INDUSTRIAL FLOATS are built for open or closed tank operation at low or high pressures. Catalog available.
Page 143 Item 261

DIAL THERMOMETERS by Trerice are neat in appearance, easy to read, have wide temperature ranges, and are cataloged in Bulletin 500-M.
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CERAMIC HEAD GAS BURNERS (Thoro-Mix) available from Power Flame Div., completely described, with specifications, in literature offered.
Page 144 Item 263

AIR VELOCITY METER No. 400 by Dwyer is one instrument which tells both air velocity and static pressure. Literature and prices available.
Page 145 Item 264

391 STANDARD VENTILATORS plus complete facilities to design and manufacture special units is the proud boast of The Burt Mfg. Co. Complete line data book offered.
Page 146 Item 265

PACKAGED INDUSTRIAL FANS by Clarage are ready to run. New type XL has hinged cover completely enclosing motor, drive, and bearings. Information available.
Inside Back Cover Item 266

INDICATING RECEIVER by Johnson for pneumatic transmission systems provides direct indication of temperature, pressure, humidity, etc., for which transmitters are available. Bulletin G-1200.
Back Cover Item 267

Advertisements in this issue are summarized on the Ad-Digest pages preceding this page. If you want more information on advertised products, locate the Digest item number of that advertisement, circle the item number on either of the post-cards provided below.

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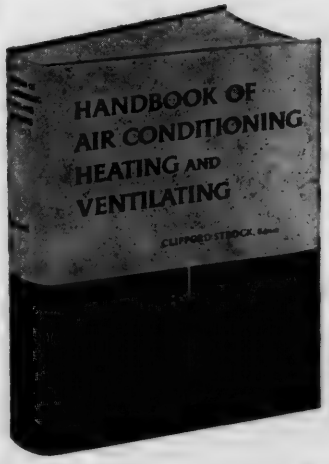

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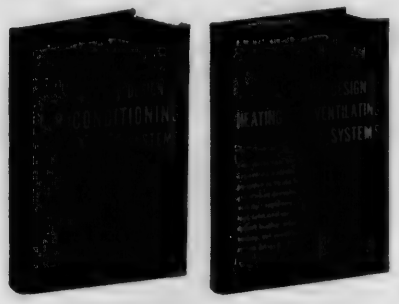

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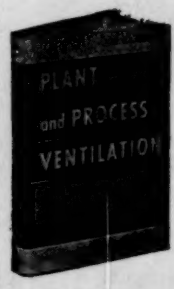

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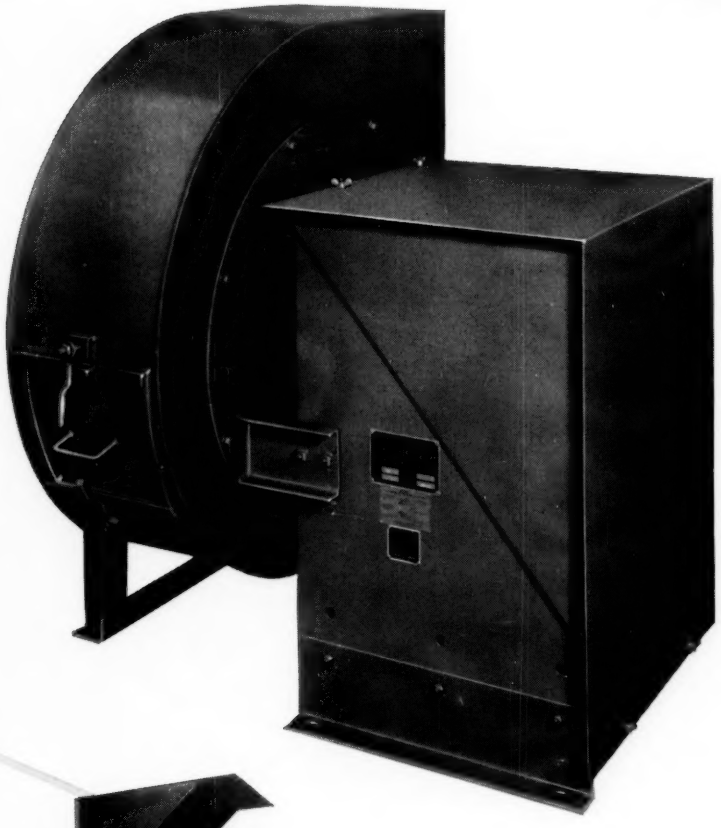

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